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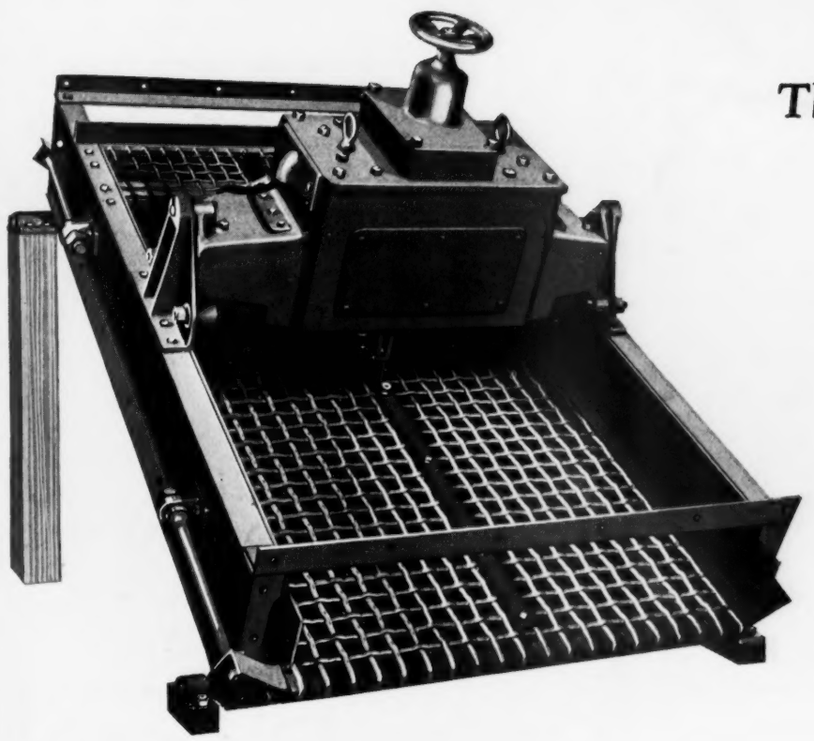
Chicago, February 15, 1930 (Issued Every Other Week) Volume XXXIII, No. 4



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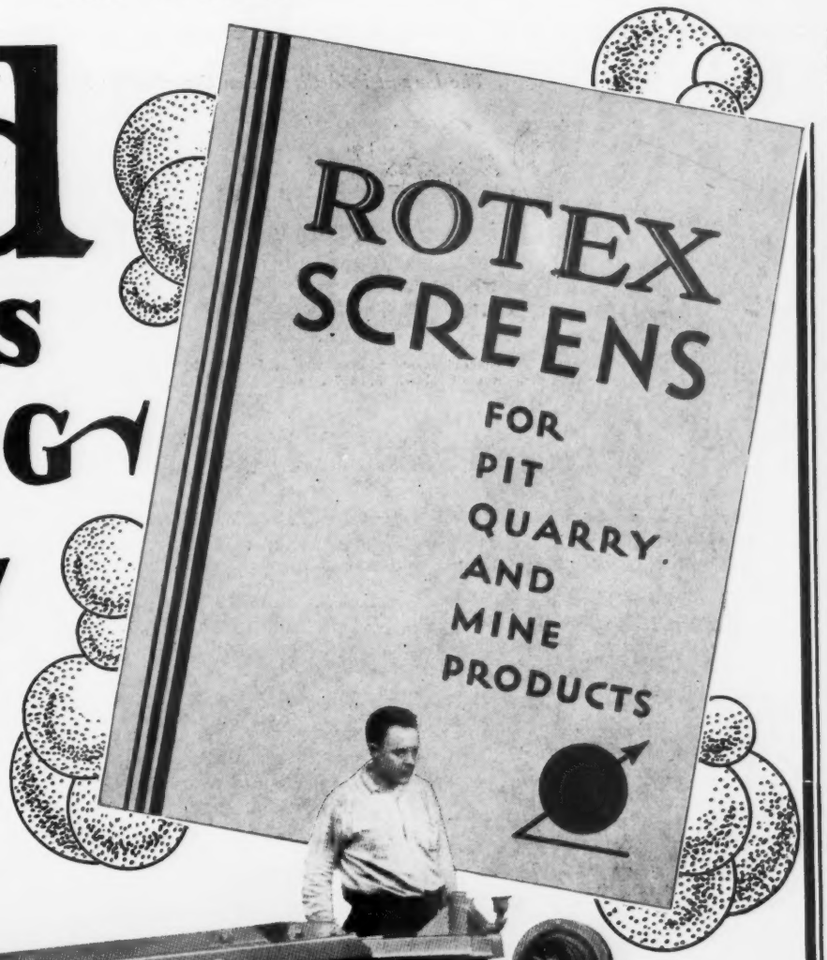

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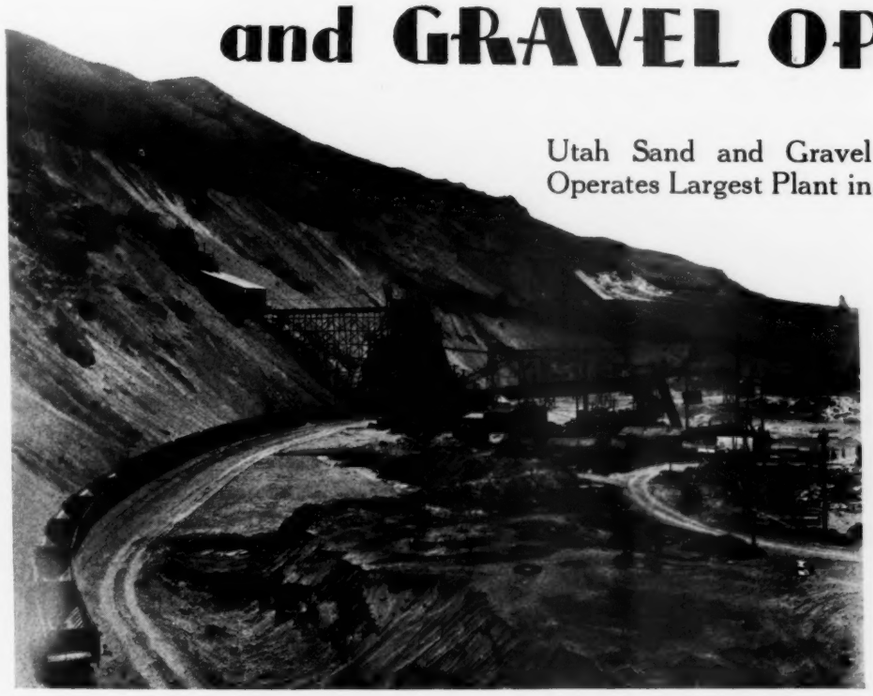
A MOUNTAINSIDE SAND and GRAVEL OPERATION

Utah Sand and Gravel Products Corporation Operates Largest Plant in Rocky Mountain States



The deposit lies over the face of the high mountain with the plant at the base

THERE ARE NOT MANY sand and gravel plants in the United States that have so many unusual and interesting features as that of the Utah Sand and Gravel Products Corp. at Salt Lake City, Utah. If we listed these features in any semblance of order it might appear that those mentioned first in the list were more interesting or more important than those at the last of such a list. Such is not the case, however, as the entire operation has so many unique features that it would be difficult to pick out the most interesting.

To a visitor at this plant the question first arises, why has a plant located far off the beaten tracks, in a country having a small population scattered over a vast area—a plant in a location where sand and gravel is to be had by everyone who owns a shovel—why has such a plant a successful and growing business? To answer, going back over our records, we find that we published in our October 16, 1926, issue a description of this operation and included some material regarding cost-keeping methods. In commenting recently on this cost record system, Eric Ryberg, president of the company, said: "We have continued the same system and believe it is responsible to a considerable degree, for our success, because we know at all times our cost."

After inspecting the company's deposits and plants, its newly acquired operations, those formerly operated by the Stauffer Sand and Gravel Co., and becoming familiar with conditions in the Rocky Mountain section and the East as well, the editor could hardly refrain from thinking what success would follow Mr. Ryberg were his opera-

Washing plant, loading bins and stockpiling conveyor (right)

tions and organization bodily planted in some of the larger industrial sections.

As one enters or leaves Salt Lake City on any of the main transcontinental railroads one can hardly help noticing the many scars on the hillsides where some railroad company or individual had in the past taken out some sand and gravel. These operations are all practically extinct now, for those producer-users soon found that they could get a better product, cheaper, through the Utah Sand and Gravel Products Corp., so they quietly withdrew from the picture, leaving Mr. Ryberg's company and its associated companies alone in the field.

The Deposits

Few deposits of sand and gravel in the United States compare in magnitude and quality of material with that of this company located within the city limits of Salt Lake. The company's holdings contain 50,000,000 tons of bank material that will average 85% gravel and 15% sand, of which 75% of the gravel is under 2-in.

The deposit lies over the face of a high mountain, spreading out fan-like at its base, having been left in that position by the gradual recession of the waters of the Great Salt Lake. Three great benches on the side of this mountain, a branch of the Wasatch range, marks three periods in the geologic history of the Great Salt Lake basin, and accounts for the remarkable deposits, in some places 200 ft. deep, located at several places along this mountain range.

Drag scraper delivering to bar grizzly ahead of newly installed conveyor at the Utah pit

While the plant has been in operation many years, the operation has been altered and improved from year to year, taking advantage of the latest in engineering practice, so that today the plant stands as a monument to one man's efficiency and application of economy.

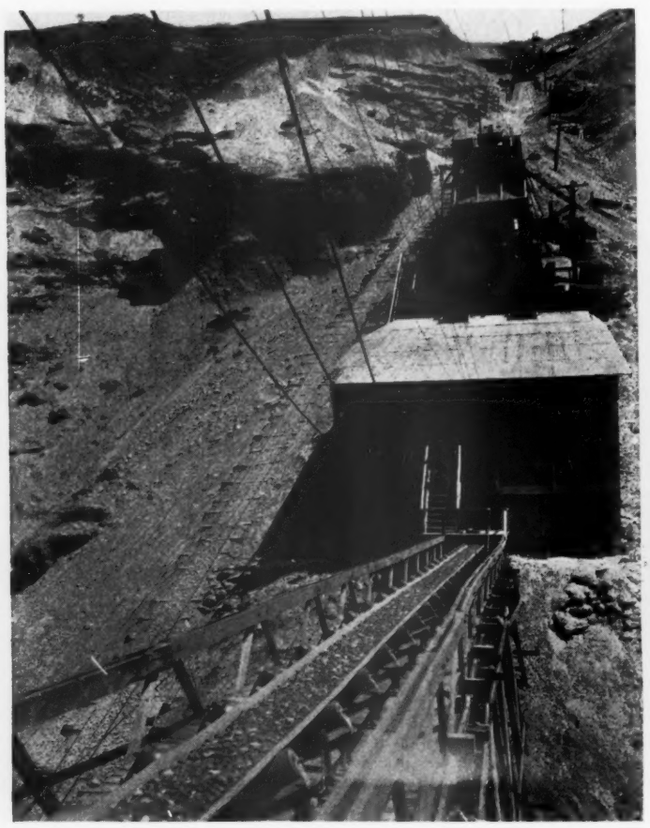
Flexibility of Plant and Variety of Output

By a careful study of the flow sheet accompanying this article it can be readily seen that the plant is arranged to do economically about all that any sand and gravel operation can be called on to do; any size of gravel, any size of crushed gravel or crushed stone, dry material or washed material; control of the sizes produced; volumetric batching for truck delivery or trainload shipments; any combination at any time. These are only a few of the features of this plant that permit us to say that its design embodies flexibility to a degree found only in a few plants anywhere in the United States.

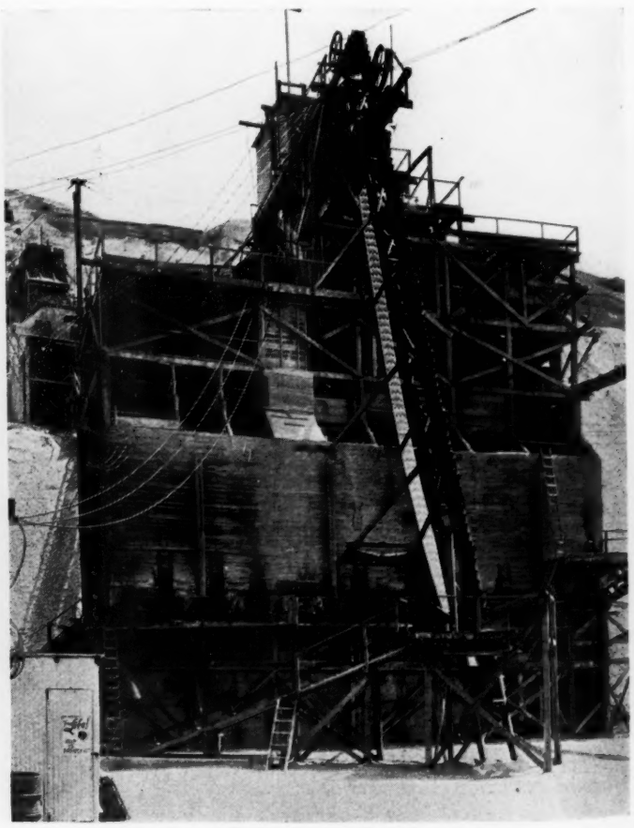
If we were to be questioned on this last point by doubters we could in defense call the skeptic's attention to the fact that the Utah Sand and Gravel Products Corp. can use hot water for washing its material, as such water is pumped from a well 70 ft. deep and delivered to the plant at a temperature of 108 deg. F. Also, we might mention that the company quarries and crushes limestone that underlies the gravel deposits and incorporates this feature in with its operation, mixing or keeping the crushed stone separate as it suits requirements.

Excavating Methods

Material from the pit is handled by a 3-yd., company-made, drag scraper, using a



Belt conveyor taking material away from cone crusher



Reclaiming conveyor and elevating system at the Utah plant

The conveyor at the left feeds bank material to the crusher at the junction; the conveyor (right) is carrying crushed material

Field crusher (right) discharging to conveyor feeding the Stauffer plant over the hill

60-ft. boom, situated about 700 ft. back from the screening plant, and at a point about 425 ft. above it. The drag scraper is driven through a two-drum, Thomas hoist, motored to a 100-hp., General Electric motor, direct-connected to the hoist. At the time the plant was first visited by a member of ROCK PRODUCTS' staff in 1926, the 3-yd. drag bucket discharged over a bar grizzly and hopper that served two cars running in the tunnel and skipway. The method of handling is practically the same now except that a 200-ft., 30-in. Stephens-Adamson conveyor has been installed between the drag-bucket operation and the skipway. The second hopper is situated at the end of a tunnel about 60 ft. long and 12x12 ft. Two steel end-dump cars, 6-yd. capacity each, and of the company's own make, operate in this tunnel, and on the skipway, which is 600 ft. long. There is a single, 36-in. gage track in the tunnel, but loaded and full cars are switched automatically on a "Y" track about 100 ft. below the mouth of the tunnel. A 1⅛-in. wire rope over a 60-in. sheave is used on the skipway. An operator is stationed at the sheave and the hopper and takes care of both loading and manipulation of the cars on the skipway.

Screening and Crushing

At the end of the skipway another bar grizzly is located over the main 48-in. by 18-ft., Stephens-Adamson scalping screen, having 2½-in. perforations. The cars are dumped automatically on top of this grizzly. Oversize from the screen passes to one of two No. 4 Telsmith crushers, driven by 45-hp. motors. If necessary, material can now be chuted over a 40-ft. center, 24-in. conveyor into a 36-in. Symons disc crusher, or can pass on to the main conveyor and to the screening plant. The screenings are mixed with the discharge from the Telsmith crushers.

The main conveyor, which handles all the material passing through the plant, is 175-ft. centers, 24 in. wide, a 5-ply Goodyear belt, and was installed late in 1926. Since that time it has handled 1,500,000 tons of material.

The screening plant remains practically the same as originally installed, except vibrating screens have been added to take care of the finer sizing. The screening plant is constructed in two units, one side for dry screening and the other for wet. The discharge from the main conveyor goes into a junction box and from there to the dry or wet side of the screen plant, as desired. The wet side equipment includes four 36- and 52¾-in. diameter by 72-in. Gilbert screens, arranged in two rows, with perforations 2 in., ¾ in. and $\frac{5}{16}$ in., respectively. Screenings from the last section go to two "Hummer" vibrators with $\frac{5}{16}$-in. perforations, and along with the water flow by gravity to hydraulic classifiers; the spigot product of these classifiers drops to the receiving tanks of two drag classifying and dewatering machines. The screens are so arranged that any combination of sizes as desired can be secured.

Water is furnished at the rate of 1000 g.p.m. by a two-stage 6-in. Fairbanks-Morse pump, driven direct through a 50-hp. Fairbanks-Morse motor, situated in a pump house about 150 ft. from the plant, out of a well 70 ft. deep, delivering hot water of about 108 deg. F. The waste water from the screens goes through a flume to a sump about 500 ft. away from the plant, and is then piped about 3500 ft. to low lands out in the valley, to a 20-acre diked silt pond.

Near the bottom, and at the side of the storage bins, a 60-ft. centers, belt conveyor has been installed on to which material can be drawn from any bin and passed to a 36-in. Symons cone crusher for further reduction. The crusher discharges to a second inclined, 45-ft. centers, conveyor inclined at 18 deg., and thence to a 76-ft. Stephens-Adamson bucket elevator that returns the crushed material to the Gilbert washing screens. By this arrangement, when the market is light on the larger sizes of gravel or crushed stone these sizes can be recrushed and returned.

Layout of field conveyors feeding field crusher (right center) at the Stauffer operation

Sand can be drawn on to another belt conveyor that elevates and conveys the sand to a point over an outside storage pile for discharge. The sand in this storage pile can be reclaimed by a belt conveyor operating in a tunnel below the reclaiming belt, discharging to railroad cars or trucks.

The dry side of the screening plant is the same as previously described and is equipped with two 42-in. by 14-ft. Stephens-Adamson rotary screens, each section perforated for ¼-in., 1¼-in. and 2-in. material, respectively.

As previously stated, the gravel deposit is underlaid with a very hard limestone suitable for concrete and asphalt pavement work. At the present time the company is producing crushed stone from its run-of-pit oversize, 2½-in. plus. At times the demand for crushed material is such that quarry operations are conducted.

The primary crusher has been installed in the quarry and breaks the rock down to 6-in. size, and it is then delivered to a 700-ft., 24-in. belt conveyor serving the secondary crushers. From the secondary crushers the stone is conveyed by another conveyor to the dry screening plant.

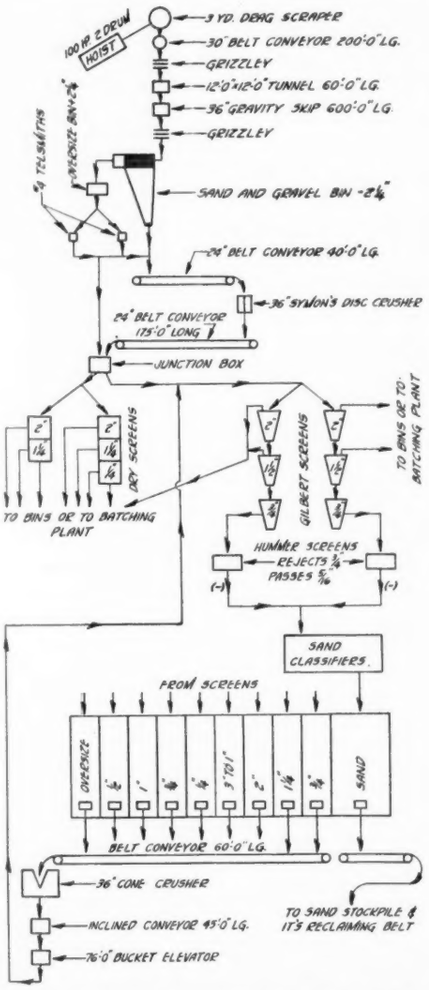
Batching Plant

In addition to the alterations already described at the Utah plant, a batching plant using Blaw-Knox batchers was installed during 1929. The batching plant consists of bins holding 150 tons, erected alongside of the screening plant. The stone and sand are chuted directly from the screens to the batching plant bins, so that the operating cost of changing bins is negligible, only requiring the attention of a plant man occasionally to divert the material from regular plant flow to the batching bins.

The screening plant of the Utah Sand and Gravel Products Corp. is located so that all of Salt Lake City is within seven miles of the plant, even the extreme farthest parts of the city. The average haul for city work is approximately 3½ miles. The plant is also served by all the electric and steam railroads in the Salt Lake area.

Planning Ready-Mixed Concrete Plant

The company is now planning on a ready-mixed concrete and batching plant located nearer to the center of the city and on the Union Pacific tracks. Sand and gravel will be shipped by rail from the screening plant. A 60-ton car entails only a freight charge of $7.20 per car. This makes a very low cost for material movement and will give the company a mixing plant that will have an average haul of only two miles to any part of Salt Lake City.



Flow sheet of operations, Utah Sand and Gravel Products Corp.

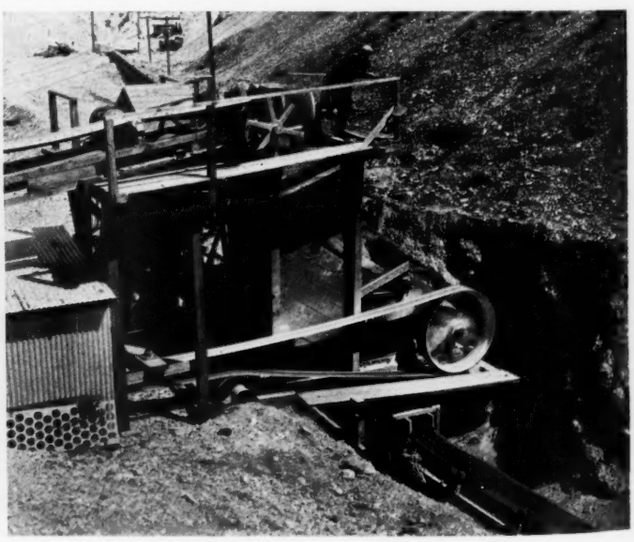
The Stauffer Plant

During June, 1929, the Utah Sand and Gravel Products Corp. purchased the Stauffer Sand and Gravel Co., which during 1927 merged two other companies with itself. The Stauffer company's deposit and plants adjoin those of the Utah company. In the purchase of the Stauffer Sand and Gravel Co. the Utah company really purchased three competitive plants and continued the operation of them under their original organizations. The purchase involved about 120 acres containing deposits of sand and gravel estimated to contain millions of tons of material, as well as a deposit of limestone and one of silica sand.

During 1929 the Utah company improved the newly acquired properties, considerably but not completely—the improvements installed to date being a new 3-yd. drag scraper powered with a 100-hp. Thomas hoist and approximately 1100 lin. ft. of 20-in. Stephens-Adamson, ball-bearing, belt conveyors that are powered with Fairbanks-Morse, ball-bearing motors, using Texrope drives. Goodyear belting is used. The primary crusher used as a field crusher is a No. 3 Climax jaw crusher having 18-in. by 30-in. opening. Two No. 3 Allis-Chalmers gyratory re-crushers were also added during 1929. The new owners made but few alterations in the old plant acquired by the purchase.

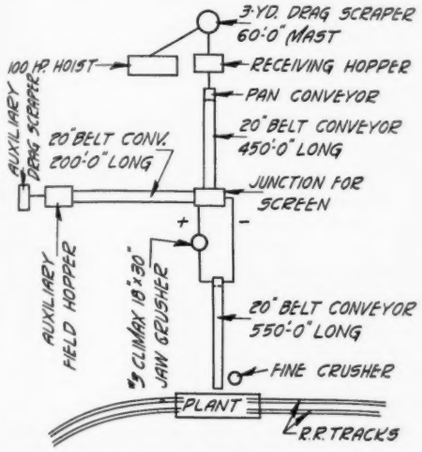
The 1100 ft. of conveyors referred to are to transport the sand and gravel from the field drag scrapers to the field crushing plant, where a preliminary crushing is given, after which the material passes to a second belt delivering to the old Stauffer screening plant.

Drive arrangement at one of the belt conveyors



Field crusher at the Stauffer operation

During 1930 it is planned to supplement the old plant of the Stauffer operation with a modern washing plant of about 1500 tons per day capacity. When this plant is installed it will bring the total capacity of the Utah corporation up to 4000 tons per day, although if railroad ballast is included the Stauffer operation as it now stands can produce 3000 tons per day alone. The new



Arrangement of field hoppers and belt conveyors at the Stauffer plant, Utah Sand and Gravel Products Corp.

plant will be of reinforced concrete and will use two tracks for car loading, with a batching plant for truck loading. Tentative plans call for rotary screens with the fines passing over vibrating screens for final classification and cleaning. The oversize will be crushed and returned to the primary rotary washer, thus completing the plant cycle.

One of the principal sources of business in 1929 for the Stauffer operation was railroad ballast. Some ballast is passed through the plant and processed, but a considerable tonnage is loaded direct to cars by steam shovels and scraper bucket. This property handled approximately 300,000 tons of ballast last year.

Another source of business for this property is a large deposit of pure silica sand. To date no particular development has been made in the movement of this sand except the production of some foundry sand, with a few carloads sent to southern California for the manufacture of glass. The company is now actively engaged in developing the silica deposit for various uses, largely for the production of glass sand, and is anticipating a very substantial business from that source.

The offices of the Utah Sand and Gravel Products Corp. are at the plant. Eric Ryberg is president and general manager; J. E. Hatch, secretary and treasurer; L. D. Mortensen, superintendent; Roy Snow, office manager.

The attractive office building at the Utah plant

World Production of Mica Increases Steadily

THE ANNUAL world output of sheet mica has grown in three decades from 1250 short tons to more than 10,000 tons, according to the United States Bureau of Mines, Department of Commerce, which has conducted an economic study of the subject. The world production of scrap and ground mica has also increased greatly, but no figures on the production of scrap and ground mica are available. India has long been the leading producer of sheet mica; however, other British possessions, notably Canada, which produces phlogopite, and South Africa and Rhodesia, which have recently greatly expanded their output of muscovite, also contribute substantially to filling the rapidly increasing demand for mica. Madagascar has become a large source of phlogopite sheet and splittings. Argentina, Brazil, Guatemala, Japan and Russia produce minor quantities of mica. During the last decade for which figures are available (1919 to 1928 inclusive) the United States produced approximately 11% of the world's output of sheet mica.

New Hampshire and North Carolina are the chief producing states. Normally, fully one-half of the American output of sheet mica has come from New Hampshire and more than one-third from North Carolina. Both states, especially North Carolina, produce yearly large quantities of scrap mica, although substantial quantities of this quality of mica are also produced in other states, notably Colorado, Connecticut, New Mexico and South Dakota.

The Mica Group

The mica group contains a number of distinct minerals which, though more or less similar in physical properties, vary greatly in chemical composition. The common varieties of mica are as follows: muscovite, phlogopite, biotite, lepidolite, rescoelite, paragonite, zinnwaldite and lepidomelane. The micas are commonly classified according to their characteristic component. Muscovite is called potash mica; phlogopite, magnesium mica; biotite, iron mica; lepidolite, lithium mica; roscoelite, vanadium mica, and paragonite, sodium mica.

Muscovite and phlogopite are the micas of commerce. Both varieties occur in comparative abundance and are found in crystals or "books" of sufficient size to yield fairly large sheets. They also possess the transparency and dielectric strength which are the most desirable properties of mica. The other varieties of mica do not possess the qualifications necessary for industrial use in the same fields in which muscovite and phlogopite are employed, although some of them have other characteristics that have brought them into a limited commercial use.

White Variety Most Important

Muscovite, or white mica, is the most important mica and is the only variety mined extensively in the United States. Phlogopite, more commonly known as amber mica, has not been found in the United States in commercial quantities, although it has been noted in small deposits in some areas. Deposits in New York and New Jersey were worked for a short time but did not prove to be large enough to justify continued operation.

Mica possesses a peculiar combination of useful physical properties. Its perfect cleavage, high dielectric strength, mechanical strength, flexibility, transparency, mechanical stability, heat resistance, nonabsorption and luster have made the mineral serviceable in many industries. For many purposes it is virtually indispensable, as no satisfactory substitutes have been found.

Industrial Uses

Natural sheet mica is used principally in flat insulation, the larger sizes being employed in a wide range of shapes. Mica splittings, which are very thin sheets of mica, are used with suitable cement in the manufacture of built-up mica board and other forms of electrical insulation. Tapes, cloth and paper faced with mica splittings are also used for insulating. Both sheet and built-up mica are used to some extent for decorative purposes, notably in lamp shades, and coarsely ground mica is extensively employed as "Christmas tree snow" during the holidays and for decorative purposes on post cards, wall paper, stucco and plasters.Ground mica is used in great quantities in dusting automobile tires, rolling roofing and asphalt shingles and as a filler in rubber goods, particularly soft rubber articles and plastic wall finishes.

For electrical insulating purposes both muscovite and phlogopite are used. Vermiculite, calcined and ground, is preferred to other varieties of mica for heat-insulating and sound-deadening purposes and also competes with other kinds of ground mica for decorative finishes, and in paints and lubricants. Biotite is also employed as ground mica.

Information Circular 6205 contains details regarding the occurrence, chemical composition and uses of mica, mining and manufacturing methods, grades and specifications, etc. Copies of this circular may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

Gypsum Industry on the Pacific Coast

Part II—Industrial Developments in Southern California in the Industry Keeps Pace with That Section's Rapid Growth

By Walter B. Lenhart
Associate Editor, Rock Products

KENDALL and Delaney are building contractors in Los Angeles and have constructed some of the largest and most beautiful buildings of which southern California boasts; and in connection with their work the firm operates a staff and casting shop at 700 E. Florence Ave. Several years ago their plaster requirements were of such a volume that they took over an old mill and gypsite deposits near Palmdale, Calif., intending to make their own plaster. They operated this mill only a short time, but still control the property, and John H. Delaney, who is

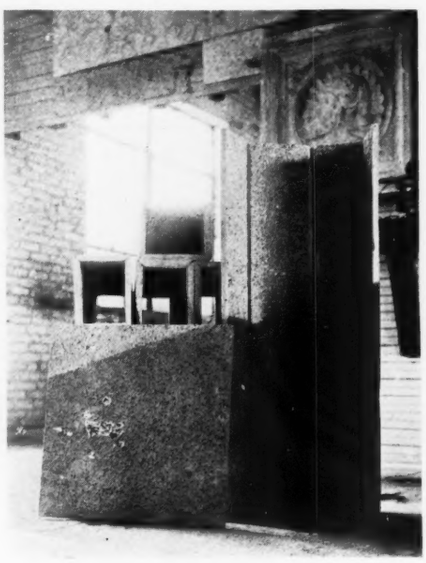
Acoustical sound-absorption ducts are gaining in favor

one of the inventive geniuses of the plaster industry on the Pacific coast, says he hopes eventually to develop a method of handling this material economically and to raise the quality of the product. Judging from the resourcefulness that he has displayed in perfecting new gypsum products and uses for gypsum there may be some surprises in store for those who are familiar with the operation. This deposit is only 80 miles from the center of Los Angeles, and as all the other mills' quarries are at least 320 miles distant, he has a big advantage, provided he can work out some method, as previously mentioned.

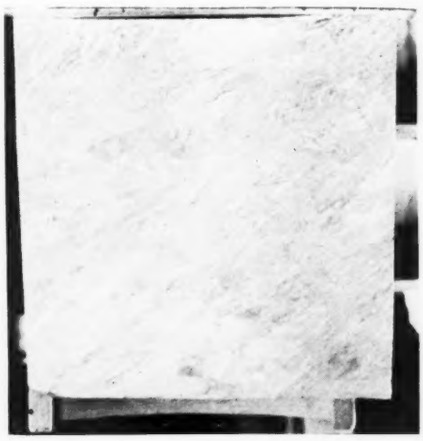
Mr. Delaney has developed an acoustic wall-board using gypsum stucco to which is added certain bubble-forming chemicals similar to Insulex, he has, moreover, patents for the use of light weight wall-board made from this class of material. To this material he adds a certain amount of coarsely ground "Zonolite" as a light weight aggregate, and also to give the outer face of the board a pleasing appearance. The wall-board is made in thicknesses from ¾ in. on up to any desired thickness, and has only one paper face, the other being left smooth except for the pores due to the chemicals added. The beautiful effects that Mr. Delaney has accomplished can only be appreciated by seeing some of this wall-board.

The board can be made by simply adding the gypsum mixture to the paper and leveled off to uniform thickness with a suitable scraper, or can be made twice the desired thickness with a bottom and cover paper, and when the plaster has set, the thick board can be split by means of a specially designed band saw.

The Zonolite referred to is a form of mica which has the property, when heated slightly, of expanding some 15 times its original volume, and at the same time changing its color from a dull black or gray to a beautiful gold. Another variety of this same material changes to a silver hue when heated. Both are, after heating, practically inert, very light in weight, have excellent fire-resisting and sound-proofing properties, and when used in wall-board of this type make a board that can readily be nailed in place or handled like any wall-board. It is finding a large use



A wallboard that folds is a novel development



Artificial travertine made from gypsum

for sound absorption and control in public buildings of all kinds.

He has also developed a wall-board that can be folded so as to conform to any structural members, such as to protect or cover steel columns, etc. This is done by simply longitudinally creasing ordinary wall-board at three or more parallel places, while the gypsum is still in the plastic stage. This creasing squeezes the gypsum out and away from the bottom and cover papers at that point so that after the plaster has set the board can be folded at those paper joints. All that it is necessary to do to make this board on practically any wall-board machine is to install creasing rolls at the desired points.

This same idea has been applied to the manufacture of the acoustical board previously mentioned and the board so made folded into the form of rectangular ducts.

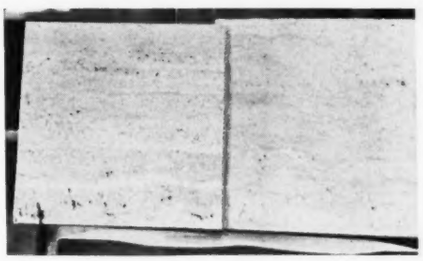
Modern construction of apartment houses, hotels, etc., requires that the sounds or noises in one room shall not be transmitted to adjoining rooms and so far as the walls are concerned this problem has been easily solved, but the problem of sound transmitted through the ventilators, as for instance bath room vents, is very different. Mr. Delaney makes up a series of these acoustical ducts

and installs then in parallel rows, when possible, in such ventilator shafts so that the sound waves pass through the parallel series. The cross-section of each duct is kept down to about 6 by 8 in., but no matter how large the ventilator shaft, enough of these tubes are installed to fill the space. The result is that the sound waves, in passing through the ducts are absorbed by the acoustic material of which the ducts are made. Thousands of lineal feet of these ducts have been placed in service, notably in the sound-proof studios of the moving-picture industry.

The folded wall-board, previously described is also used as a floor filler by simply folding the board so that its exterior is in general appearance like an ordinary hollow gypsum tile, except that it is enclosed in its paper cover. The wall-board can be folded in any desired shape and to fit any space between floor or ceiling joists. It is possible to fold it so as to make a lap joint if desired. By the use of this material dead space in walls, floors or ceilings can be filled with light weight, sound-proofing gypsum material that can take, if desired, an outer decorative plaster coating.

Novel Casting Form

Another invention that Mr. Delaney has developed and one that should be of interest not only to the gypsum industry but to the concrete products industry is his method of casting intricately designed shapes of concrete. The pattern of the object to be cast is placed in cheaply constructed "flasks," identical with those that are used in the steel and iron foundries and is completely covered with the lightweight, wet gypsum material to which the bubble-forming chemicals have been added. The material sets in a few minutes, the flasks are halved and the pattern removed. The mold is then filled with the concrete aggregate and allowed to set and to age in this mold. No further sprinkling or attention is given to the aging process as sufficient water is retained by the porous gypsum to keep the concrete cast damp, and if the mold is made thick enough it will take months to dry out on account of its heat-insulating properties. If it is desired to ship this cast object by truck to any distant job, the flask, acoustic plaster and cast are shipped, and the casting is not even removed until the job is reached. As the acoustical plaster is porous it necessarily is ideal cushioning material and prevents breakage or chipping of any of the fine lines in the cast, and as it is of light weight the freight on the packing material is less than were some of the more common packing materials used. As only a small amount of gypsum is necessary, the mold being mostly air bubbles, the cost of the gypsum used is practically negligible. It might be thought that the porous nature of the mold would leave the cast rough, but that is not the case as at the time the mold is filled, each one of the bubbles is more or less filled with water; in any event the concrete objects when removed are as smooth surfaced as any produced by more familiar methods. The molds can only be used once, but in many cases, especially with cast objects of a highly complicated nature, only a few are



Many experts cannot identify properly this artificial travertine

wanted. Anyhow, the original cost of the entire mold, as far as material is concerned, would not be much greater than it would cost to pack one of these objects for shipment.

All of the products described in connection with the Kendall and Delaney plant are patented, but Mr. Delaney is willing to license the right to manufacture them to responsible and interested parties.

Artificial Travertine

Still another gypsum product made by Mr. Delaney is artificial travertine that is so neatly executed as to require an expert to detect the difference between it and the real article. He makes this by sprinkling dry carbide over a marble slab and splashing over this a wet mixture of Keene's cement. After the material has set the face of the cast is washed off with a hose, and the resulting cast after dressing and polishing gives a remarkable and beautiful gypsum product.

Mutual Income Properties, Incorporated

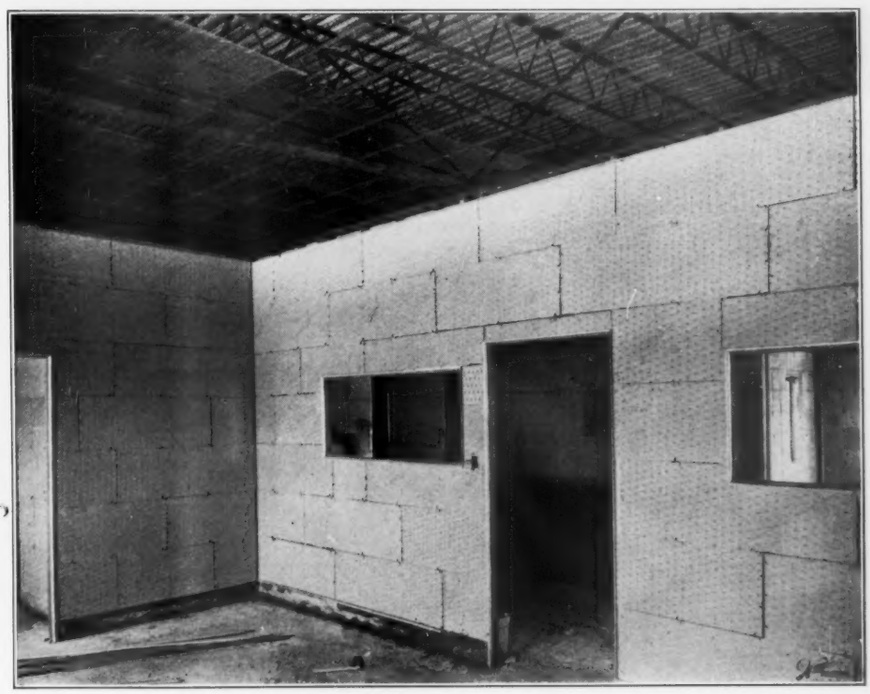
The Klinch-Lath Corporation until recently had two plants, one located at 53rd and So. Alameda St., and one at 3005 East 25th St., Los Angeles. The former plant was taken over by the Blue Diamond Co., as already noted, but the other plant is still operated by Mutual Income Properties, Inc. Their specialties are Klinch-Lath, Lock-Lath, steel furring, partition and ceiling construction.

The company have recently made some changes in their steel studding partition design that will make it more crack-proof than under the old construction where they had the continuous joints in the board.

The Klinch-Lath system consists, first, of a metal carrying frame made of channel irons suitably spaced, to which Klinch-Lath (plaster lath), is locked by metal clips. For carrying ceiling construction, carrying bars are first anchored on 3 ft. centers, and channel bars, with clips spaced 16 in. centers, across them. For fireproof ceiling construction, the vertical channels are anchored to floor and ceiling by metal plates nailed to the concrete and fastened to the ceiling slab.

The application of plaster-board to this construction is then very simple, it is only necessary to insert the lath in the channel and lock them in place by a simple turn of the clip or the prongs on the channel bar.

With this development of a method of fastening plaster-board to steel construc-



Shows how gypsum plasterboard has been made applicable to steel studding

tion members the solution of a much sought problem has been obtained and its use in a large number of class A commercial buildings has proven to the architects and contractors a saving in time, ease of erection, and a perfect alignment of walls so constructed.

Plaster City Plant of Pacific Portland Cement Co.

The Plaster City operation of the Pacific Portland Cement Co. is located between San Diego and El Centro, being about 18 miles east of the latter and on the main highway connecting those two cities. Climatic conditions are quite torrid in the summer, especially as the site is on the desert, but winter operations are very pleasant. Shipments are made over the San Diego and Arizona Railroad.

Type of cars used at Plaster City, Calif., plant of Pacific Portland Cement Co.

Water is hauled to the quarry in this car

The plant burned two years ago, but since that time has been entirely rebuilt with the exception of the tile plant which was abandoned.

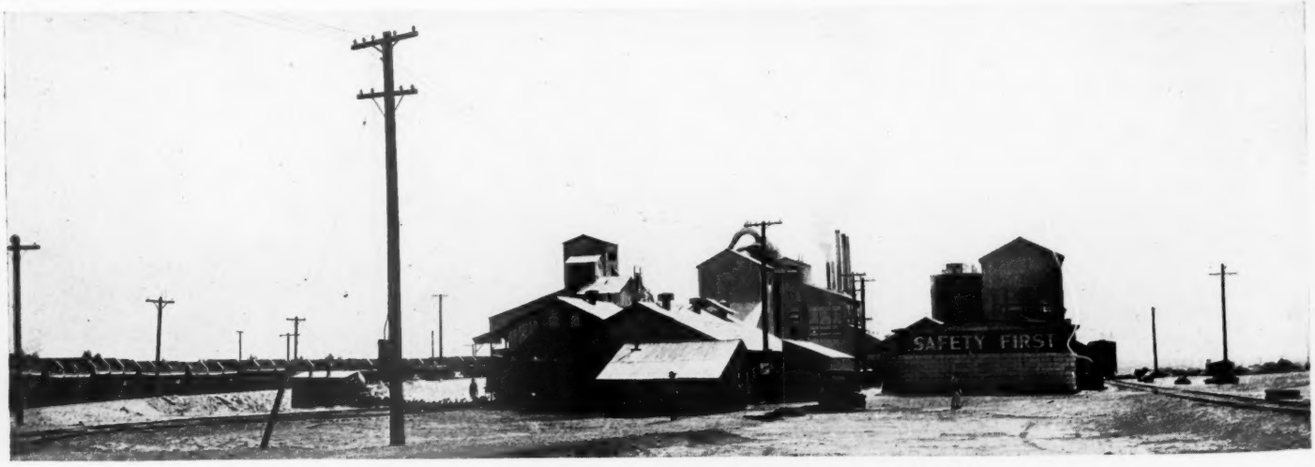
The quarry is located 25 miles from the plant and is reached by a company-owned railroad. The deposit is a mountain of high grade gypsum, containing an enormous tonnage of dazzling white gypsum rock, along the base of which the quarry has been opened up for several thousand feet. The deposit is three miles long, about 800 ft. high and ¾ of a mile thick, so one can appreciate the magnitude of the gypsum available, all of which is high grade rock and free from any inferior or stratified material. Gypsum also exists for a depth of 55 ft. below the present quarry floor.

Drilling is done with a gasoline driven well drill, using 20% Trojan dynamite for blasting. Occasionally some 40% is used, although the slower dynamites are better adapted for this work. The holes are drilled on 6 ft. centers with a 10 ft. burden. A recent shot brought down 30,000 tons of rock giving 3 tons of rock per pound of explosive. Very little secondary shooting is necessary.

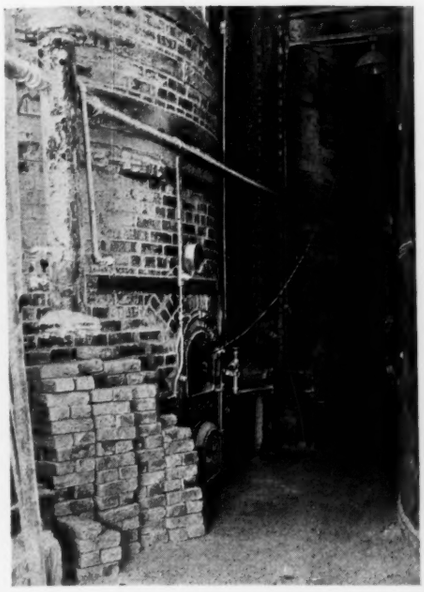
The quarry is surrounded by high mountain ranges, but strangely enough the floor of the quarry is only 54 ft. above sea level, with the railroad connecting the plant and quarry at one place, actually 6 ft. below sea level. A boarding house and quarters are provided for the men at the quarry as well as of the mill. Twelve men are all that is required to operate the quarry. Water is delivered in tank cars from the plant, for there is none available closer.

The first company to operate this quarry was the Imperial Gypsum Co.—now extinct—which had a crushing plant at the quarry. The crushing now, how-

Loading crude crushed gypsum from stockpile at Plaster City, Calif.



General view of the Plaster City, Calif., plant of the Pacific Portland Cement Co.



Oil-fired kettles at the Plaster City plant

ever, is all done at the Plaster City plant.

The rock is loaded by a No. 36 Marion steam shovel to flat cars on which are mounted three pans, each pan holding 10 tons of rock; 16 to 20 cars constitute a train load, with one trip per day being all that is necessary to supply the plant. A large stock pile of crude, crushed gypsum is kept on hand at the mill at all

Steel silos for storage of ground gypsum

times of sufficient size that plant operations can continue for several months should it become necessary.

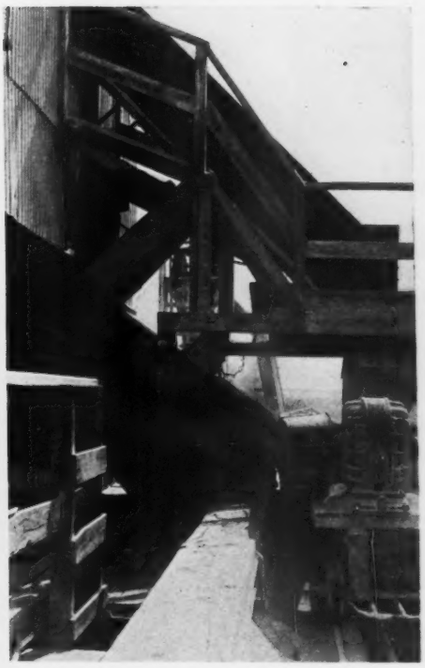
The gypsum after being crushed is elevated by a bucket elevator to a Hum-mer screen, the fines and average from which fall to a shuttle conveyor running over five, wooden, crude-rock bins. The minus 1-in. material from the screen is shipped to the cement mills in southern California. For plaster manufacture the rock is pulverized in three, low-side, five-roller Raymond mills, using No. 11 exhauster fans that discharge through cyclone dust collectors to two 400-ton steel silos. The silos are emptied by a series of screw conveyors, under the bottoms of the silos, and these

Screw conveyors and drive for reclaiming pulverized gypsum in the steel silos

discharge to a second bucket elevator, and the material spouted to the three kettle feed bins.

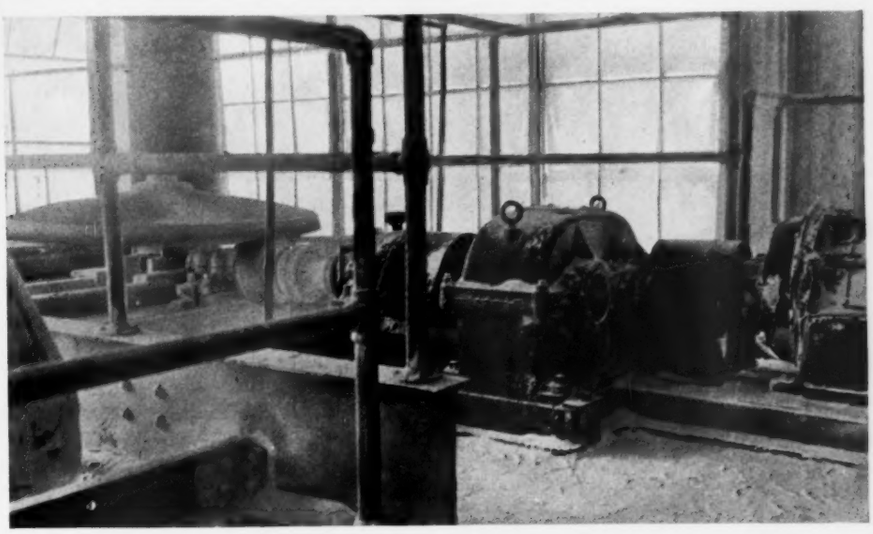
All of the mills grind from 80 to 88% minus 200-mesh for their hardwall plasters, and for casting or other higher grades of plaster 90 to 94% minus 200-mesh is maintained.

There are three 10-ft. Butterworth and Lowe kettles, oil-fired, and all are equipped with Pacific Gear and Tool Works reduction units between their individual drive

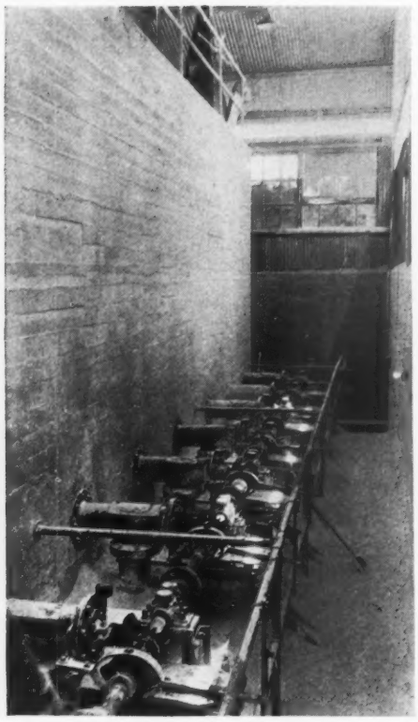


Preparation of cement rock on vibrating screens

motors and the stirring mechanism. This type of kettle drive is certainly an ideal method for this work, as it requires small floor area and eliminates the danger of moving belts in a place where from necessity, the operator must be. The bottoms are of steel, supplied by the Columbia Steel Corp., and these also have proven quite satisfactory. The fog stack rests directly on top of the kettle and is arranged in duplicate compartments, so that one may be cleaned out while the other is in use. The kettles discharge to three vented hot pits equipped with Ehrsam, hot pit emptiers that deliver to a bucket elevator and the conveyors to three steel storage silos of the same size and type used for the pulverized raw gypsum. Two of the silos are

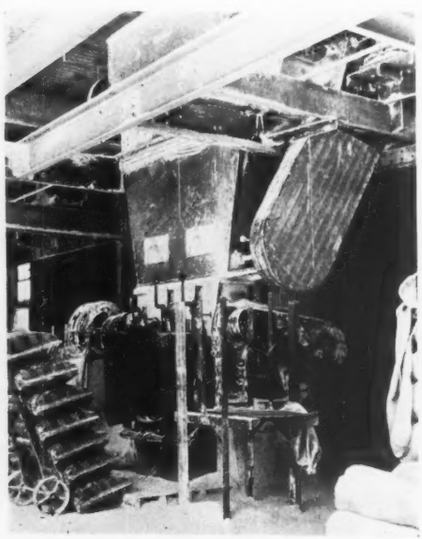


Direct-connected motors to calcining kettles makes a neat arrangement. Pacific Portland Cement Co. plant at Plaster City, Colo.



Mechanical hot pit emptiers are now used in all western mills

used for ordinary stucco and one for casting stucco. Regrinding at this plant has been abandoned as the tonnage and fineness delivered from the Raymond mills is ample, and it was found that there was no advantage to be gained so far as quality is concerned by regrinding. The mills will deliver 6 to 7 tons per hour of 80 to 86% minus 200-mesh, which is the fineness of the finished hardwall plasters. Less tonnage is secured when grinding casting plaster, which is ground to 90 to 92% minus 200-mesh. Finish and gaging plasters are ground to 78 to 80% minus 200-mesh.

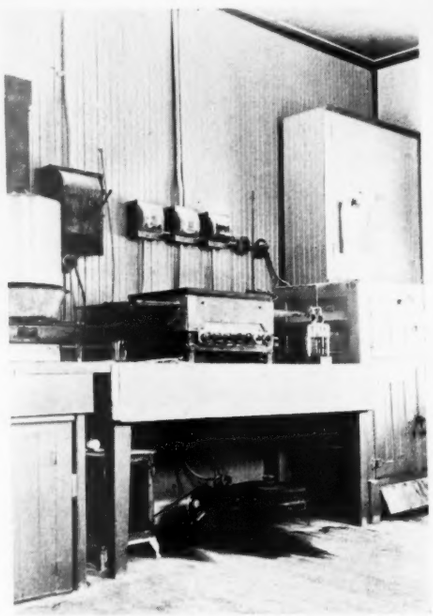


Sacking machines drives are well protected to prevent injury to workmen

Three Bates packers are used in the packing department with one-ton Ehrsam mixers. Fiber is picked in Ehrsam fiber pickers that discharge to a room constructed of gypsum tile, so as to eliminate fire hazards as much as possible. Retarder is purchased from the Universal Gypsum and Lime Co., but before use it is passed through a machine to break any lumps that might be present.

Casting plaster is made at this plant by a patented process and consists of a method of utilizing the water of crystallization that is present in raw gypsum, and imparting that water to double-boiled stucco. Borax is added prior to calcining as a hardener.

The company has developed a special agricultural compost of which raw gypsum is the principal ingredient. Elemental sulphur and phosphates are other ingredients, as well as nitrogen forming bacterial growths that are added. These bacterial growths are all grown in the company's laboratory at the plant. A large tonnage of this material is sold in California, as well as locally in the Imperial Valley district.

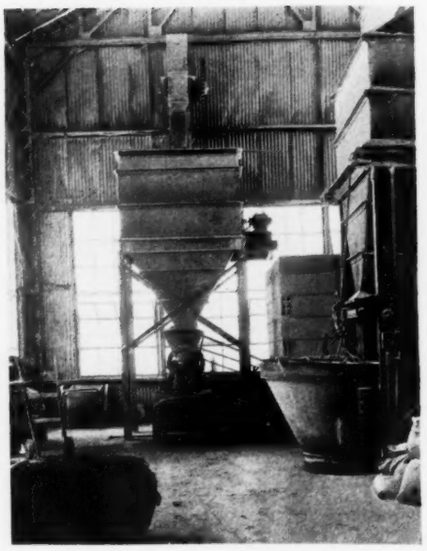


Laboratory of the Pacific Portland Cement Co., Plaster City, Calif.

The plant is equipped with one of the best physical and chemical laboratories of any of the plants on the coast. All the products of the plant (and all through their formative process) are subjected to rigid chemical control and a high quality of product has resulted.

Water is secured from Coyote Wells, 11 miles east of the plant, where the company has a well and a Diesel engine pumping unit. Delivery to the plant is by gravity with a 350 ft. drop.

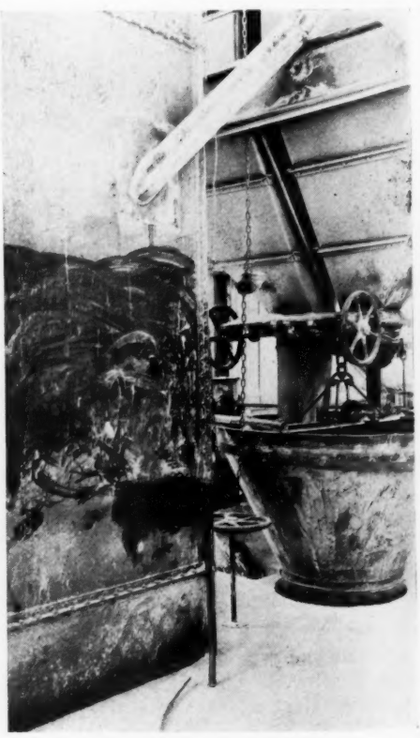
The plant has a capacity of 300 tons per day of calcined material, and is very efficient so far as labor is concerned; 20 men only are required for full capacity operations. The company purchases power from the Southern Sierra Power Co., but has its own light and power plant at the quarry, all Diesel-engine driven.



Retarder is pulverized and stored in the upper steel hopper

The company has the Pacific coast rights for Insulex, the trade name given a cellular, light-weight gypsum material, in which gas forming chemicals have been added.

A boarding house is maintained under contract by the Anderson Boarding and Supply Co., of Los Angeles. This company makes a specialty of running board-



Weighing hopper for preparing bacterial gypsum fertilizers

ing houses in western industrial construction and mining camps. An arrangement of this sort relieves the superintendent of a lot of detail that would otherwise be necessary, and as excellent meals are served, makes another ideal arrangement.

The Pacific Portland Cement Co. also has a second 5-kettle plant at Gerlach, Nev., that serves northern and central California as well as the Pacific Northwest.

Garages at Plaster City gypsum plant

Midland, Calif., Plant of United States Gypsum Co.

A noteworthy addition to the gypsum industry in California and Arizona was made in the spring of 1929 when the United States Gypsum Co. opened its Midland plant, near Blythe, in the southwestern part of Riverside county, California, about 20 miles west of the Colorado river.

Office of Pacific Portland Cement Co., Plaster City, Calif.

The property was first prospected about 20 years ago, and although the rock is almost unique in its purity and is among the whitest in California, the quarry was not developed earlier because of the difficulties of operating in the desert, where the temperature frequently registers in excess of 120 deg. in the shade. Water has to be brought from the Colorado river in tank cars.

A Desert Operation

Before describing the plant, a further word about the unusual character of the site may not be amiss. The desert round about the plant supports no animal life save lizards and tarantulas, etc., and no vegetable life save the cactus. Surrounding the scorched plain at a vast distance are stupendous rugged mountains, barren and colorless, like a circular pile of monstrous cinders.

The quarry is two and a half miles from the mill, and the rock is conveyed to the mill in cars drawn by gasoline locomotives. An Orton and Steinbrenner steam shovel is used in stripping.

No more efficient operation is to be found in any gypsum plant in the country. The flow of material through the mill is typical, consisting of primary crusher, secondary crusher, Raymond mills, calcining, regrinding, and sacking. Power is furnished by a Fairbanks, Morse and Co. Diesel engine, and the kettles are oil-fired. The usual drag-chain and screw conveyors and elevators are employed to carry the gypsum to and from the various manufacturing processes and bins, and in the warehouse Bates packers are employed.

Midland rock is used by many portland cement companies because of its high SO_3 content and ease of grinding. Owing to the glistening whiteness of this gypsum, the ground material is used in large quantities

Type of bunkhouse designed for relief during hot summers

Part of the gypsum quarry at Midland

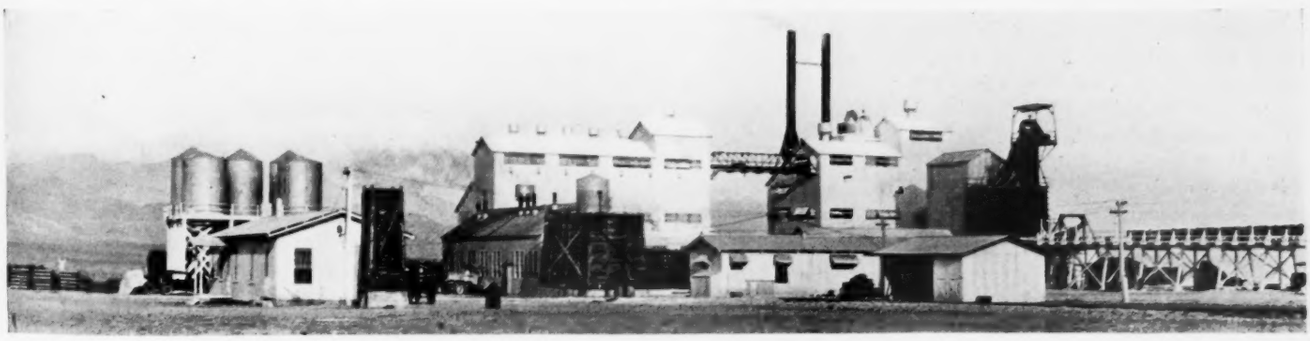
in the moving picture industry to imitate snow, the gypsum foreground being cleverly joined to a stock background by means of double photography.

Agricultural Gypsum in Demand

Other products of Midland are "Red Top" cement plaster; molding and casting plaster and finishes; manufacturers' stucco; and agricultural gypsum, which is needed by California soils, particularly those devoted to the growing of citrus fruits. So important is the agricultural business in California to this company that a department of the mill is devoted solely to its production.

Good rail facilities are afforded by the Santa Fe railroad, on which the Midland mill is located.

Everything possible has been done to make



Midland, Calif., plant of the United States Gypsum Co.

The great American desert in the vicinity of Midland, Calif., the locale of the U. S. Gypsum Co.'s operation

life agreeable at Midland. There is a company operated store and a boarding house, and comfortable homes for the staff and white employes, with a separate camp for the Mexican workers.

The United States Gypsum Co. has a second calcining plant at Arden, Nev., but manufactures no wallboard, plaster board or tile at either of these plants.

(To be concluded)

Fire Resistance of Plaster Partitions

A NUMBER of fire tests of solid and hollow plaster partitions, built by applying plaster on metal lath attached to metal studs, have been made recently in the U. S. Bureau of Standards small wall and partition furnace. The object of the tests here reported was primarily to learn the effect of different proportions of gypsum and sand in the plaster on temperature transmission through the partition. The solid partitions were built on a single layer of No. 24 gage lath (weighing about 3 lb. per sq. yd.) attached to ¾-in. plastering channels spaced about 12 in. apart. After the first scratch coat of plaster had set, one or more body coats were applied on each side to attain the desired thickness. For the hollow partitions, two metal lath and stud backings were spaced 3 in. apart by means of solid channel spacers and two coats of plaster applied on the outside of each to give a plaster thickness of about ¾-in. The proportions of mix for the plaster were determined by dry weight of gypsum plaster and sand, respectively. No whitecoat finish was applied, the outer brown or body coats being floated to a smooth surface. The partitions were seasoned from 30 to 40 days under dry-room conditions before testing.

The partitions were tested as non-bearing partitions with fire exposure on one side controlled according to the standard testing procedure. The temperatures on the unexposed side were determined by means of thermometers under asbestos felt pads 0.4 in. thick and by means of thermocouples attached to the bare surface. The ultimate fire resistance of all these partitions was determined by an average temperature rise under the asbestos pads of 139 deg. C. (325 deg. F.) above the initial temperatures. No cracks were formed of sufficient size to pass flame or smoke.

The following table gives the ultimate fire resistance of the partitions as determined on the above basis. The periods have been rounded to the nearest five minutes and have been corrected so as to apply for even thicknesses of 2 and 2½ in. for the solid partitions. This was necessary as the partitions, as constructed, varied by ⅛ to ¼ in. from these nominal thicknesses.

ULTIMATE FIRE RESISTANCE OF PLASTER ON METAL LATH AND METAL STUD NONBEARING PARTITIONS

Type	Plaster proportions by dry weight	Thickness In.	Ultimate fire resistance H.	M.
Solid	1 gypsum; 3 sand	2		45
Do	1 gypsum: 2½ sand	2		50
Do	1 gypsum: 2 sand	2	1	00
Do	1 gypsum; 2½ sand	2½	1	10
Hollow	1 gypsum: 2½ sand; plaster ¾ in. thick on each side	4½	1	15

An appreciable gain in fire resistance is secured by increasing the gypsum content of the plaster from the 1:3 to the 1:2 proportion. The gypsum in the plaster aids materially in retarding the temperature rise in the partition, since the hydrated plaster, $CaSO_4 \cdot 2H_2O$, is changed by loss of combined water to $CaSO_4$ $\frac{1}{2}H_2O$ (plaster of paris) or $CaSO_4$, depending on the temperature. This molecular change absorbs heat and the vaporization of the water set free further retards the temperature rise, particularly above 100 deg. C. (212 deg. F.). The 2½-in. solid partition is seen to give nearly the same fire resistance as the hollow 4½-in. partition. The former is less expensive to construct, although proper proportion and consistency of plaster must be used if sagging of unset plaster is to be prevented where the full thickness is applied over the scratch coat in one day.

The partitions (4 ft. 2 in. square) were smaller than the minimum size required for a standard test, but in the case of the partitions concerned it is believed that this will not introduce very significant differences in results. Well-set gypsum plaster applied on metal lath is not subject to spalling or similar disruptive effects on exposure to fire. These effects where they do occur are more likely to be destructive to the larger panel. No indication of spalling or separation of coats appeared in any of the partitions tested.

No hose stream was applied in the tests, ability to resist which is one of the requirements for a partition construction. Similar partitions have, however, been subjected to hose streams in tests elsewhere with indications of resistance sufficient for the classifications involved.

Further information on the above points will be developed in a series of fire tests of interior partitions to be undertaken in the bureau's new wall furnace which is now being constructed. This will accommodate a partition 16 ft. wide and 11 ft. high. Means are being provided for applying load to bearing partitions, as well as for conducting hose-stream tests.—*Technical News Bulletin*, of the U. S. Bureau of Standards.

Large Manganese Plant Starts Production

THE new manganese ore concentrating plant of the Hy-Grade Manganese Production and Sales Corp., Woodstock, Va., has just been completed and is now in production. Development of the Hy-Grade mine has been carried on for the past eight years and construction of the milling plant has been under way for the past year, representing an expenditure of several hundred thousand dollars. The plant has a capacity of 30,000 tons of ferro-grade manganese ore per year. The ore will be shipped to ferro-manganese manufacturers and steel mills in the East.

This is the third large domestic manganese plant to go into production in recent months. The other two are the plants of the Domestic Manganese and Development Co., Butte, Mont., and the Georgia Manganese and Iron Co., White, Ga. The potential capacity of these three plants combined exceeds 200,000 tons of ferro-grade manganese ore per year.

Explosives Progress

THE FIRST issue of a small publication, *Explosives Progress*, brought out by the Institute of Makers of Explosives, and published periodically, illustrates the variety of uses to which dynamite and black powder are being put.

Design of Clinton Point Plant, New York Trap Rock Corp.

By Melvin C. Dow
Engineer, New York Trap Rock Corp., Newburgh, N. Y.

THE construction work on the new Clinton Point plant of the New York Trap Rock Corp. was started early in October, 1929, following preliminary excavation carried on some time before. Operations at the old plant were maintained, the design permitting this condition, although it was rather difficult to maintain production and carry on the extensive construction program. Under normal conditions production was usually suspended between December 15 and January, the time the river freezes, but in order to help construction, operations were stopped on December 20, and the old plant, except conveyor "A" (see sketch) completely dismantled.

Situated on the site of the old plant, some 8 miles south of Poughkeepsie on the east side of the Hudson river, the new plant has been designed for a capacity of 800 tons of crushed limestone per hour, with possible future production of 1000 tons per hour.

Limited Area Offers Difficulties

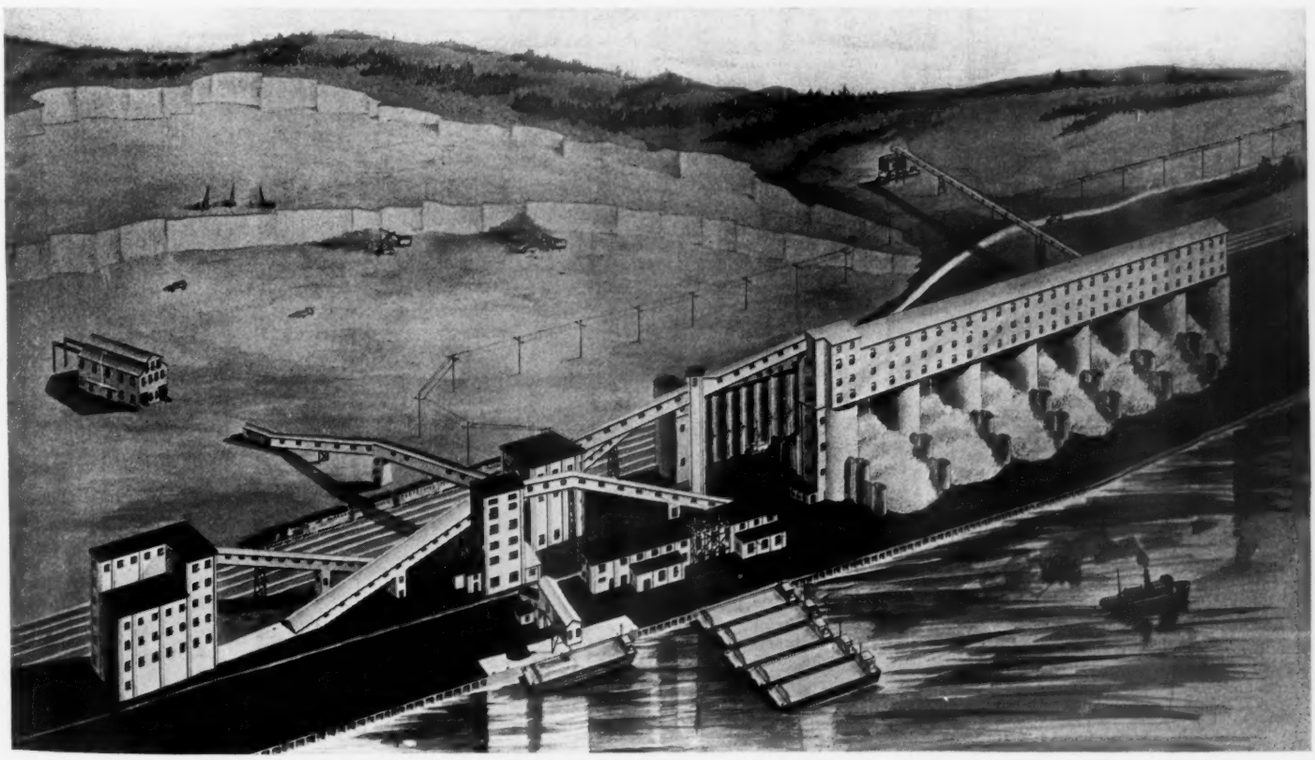
Another feature adding to the difficulty of the new construction was the confined area in which the work had to be done. The main line of the New York Central runs through the quarry, limiting the space for storing material. Again, although there was only one grade crossing at the plant, it was a quite busy point, an average of 10 trains per hour passing over it. This necessitated a watchman at all hours of the day. Under the plans this crossing will be abolished and a new overhead highway bridge, for which everything except the approaches is ready, will be used to get to the plant.

Seven Main Buildings

There are seven main buildings comprising the new plant. The No. 1 building is over the primary crusher pit, the bottom of which is 40 ft. below the quarry floor. This pit was built by us in January, 1928, in anticipation of the new plant, and has been used in conjunction with the old plant the last two seasons. Gallery "A" was built at this time and the present contract with the Burrell Engineering and Construction Co. is exclusive of this crusher pit and gallery "A." The belt in gallery "A" was originally a 42-in., but is now being replaced by a 48-in. belt and the old 42-in. belt and conveyor is to be used in gallery "H."

The No. 1 building, of all-steel construction, will contain one new trucking mechanism similar to the one already in use, so that there will be two such dumps. This truck dump is an interesting feature and is of our own design. It consists of a heavy steel framework and rails upon which a four-wheeled traveler runs. The traveler is pulled up a curved track by a 20-hp. Sheppard electric hoist. A hook suspended from the traveler engages in an eye on the side of the auto truck body and pulls it up in an even but rapid motion, dumping the rock from the truck into the primary crusher. (At present there are twelve Mack trucks in operation. The bodies were built especially for us by the Easton Car and Construction Co. and are side-dumping.)

The Mack trucks are 7½-ton capacity. Our past experience has proved that we have no difficulty in dumping at an average of 90 trucks per hour at each of the two dumps. If necessary, an average of 120 trucks per hour for each dump can be dumped. The trucks average 5 cu. yd. each of stone.



Architect's perspective of the new Clinton Point plant, New York Trap Rock Corp., now under construction

The Allis-Chalmers No. 21 gyratory crusher in use is nearly 20 years old and is still in splendid condition and from all indications will give many more years of service in the new plant. The design of the crusher pit allows easy removal of the crusher parts.

Another interesting feature is a spare main shaft for this crusher which is mounted on an old flat car and can be moved directly to the crusher site in a very short time. These shafts are very heavy and difficult to handle without special provision.

The crusher in the No. 1 building discharges on conveyor "A" which transports the rock to the secondary crusher in the No. 2 building.

The additional machinery of importance in this building is a new 40-ton Pawling and Harnischfeger traveling crane with a 10-ton auxiliary hoist. This crane extends to a yard outside of the building where it can pick up parts directly from railroad cars on one of our sidings.

Recrushing

The No. 2 building is the secondary crushing and recrushing building. It contains two 7-ft. Symons crushers and also serves as a junction house for material coming from the No. 3 building to No. 4 building. There is provision made for the future installation of an additional 7-ft. Symons crusher. Each crusher is driven by a 200-hp. Allis-Chalmers synchronous motor and is fed by an individual Traylor 42-in. manganese steel apron feeder. These feeders have a novel arrangement whereby they may be pulled back on rails out of the way of the crushers (see sketch). Over the feeders are steel gates, Timken-equipped, of our own design. The Symons crushers discharge on conveyor "B" which carries the stone to the No. 3 building for scalping.

Other equipment in this building comprises a Pawling and Harnischfeger 20-ton traveling crane with a 5-ton auxiliary; the drives for conveyors "A," "C" and "D" (see list of conveyor drives); electrical control equipment such as individual power meters for each crusher and meters showing the power consumption for each operation, viz., crushing, scalping, sizing, washing and loading, etc. These meters give a visible account of what is happening and help to anticipate motor overloads and power trouble. There are 29 of these control panels in a separate room.

Screening

The No. 3 building, the scalping screen house, contains four 48-in. by 20-ft. Allis-Chalmers screens, each driven by a 25-hp. Allis-Chalmers motor with Texrope drive. There is provision for future installation of two additional screen units. Each screen is fed by a 36-in. apron feeder similar to those in No. 2 building, and the bin gates over the feeders are similar to those in the No. 2 building.

These revolving screens scalp out plus 3¼-in. oversize which is returned on conveyor "C" to the cone crushers in No. 2 building for recrushing. The minus 2¼-in. which is removed goes to No. 4 building on conveyors "D" and "E" for final sizing. These screens also scalp out the intermediate size plus 2¼-in. to minus 3¼-in. and this size can be sent on conveyors "D" and "E" to No. 4 building for final sizing or returned to the cone crushers in No. 2 building on conveyor "C" for recrushing.

A 7½-ton P. and H. crane travels the length of the building. The drive for the "B" conveyor is also located in this structure.

Storage and Loading

The No. 4 building, or sizing screen house and storage silos, is probably the most unusual building in the plant. It consists of eight silos, each 50 ft. in dia. and 80 ft. high, placed 105 ft. on centers. Over the silos is a steel building of the mill type containing the sizing screens and conveyors.

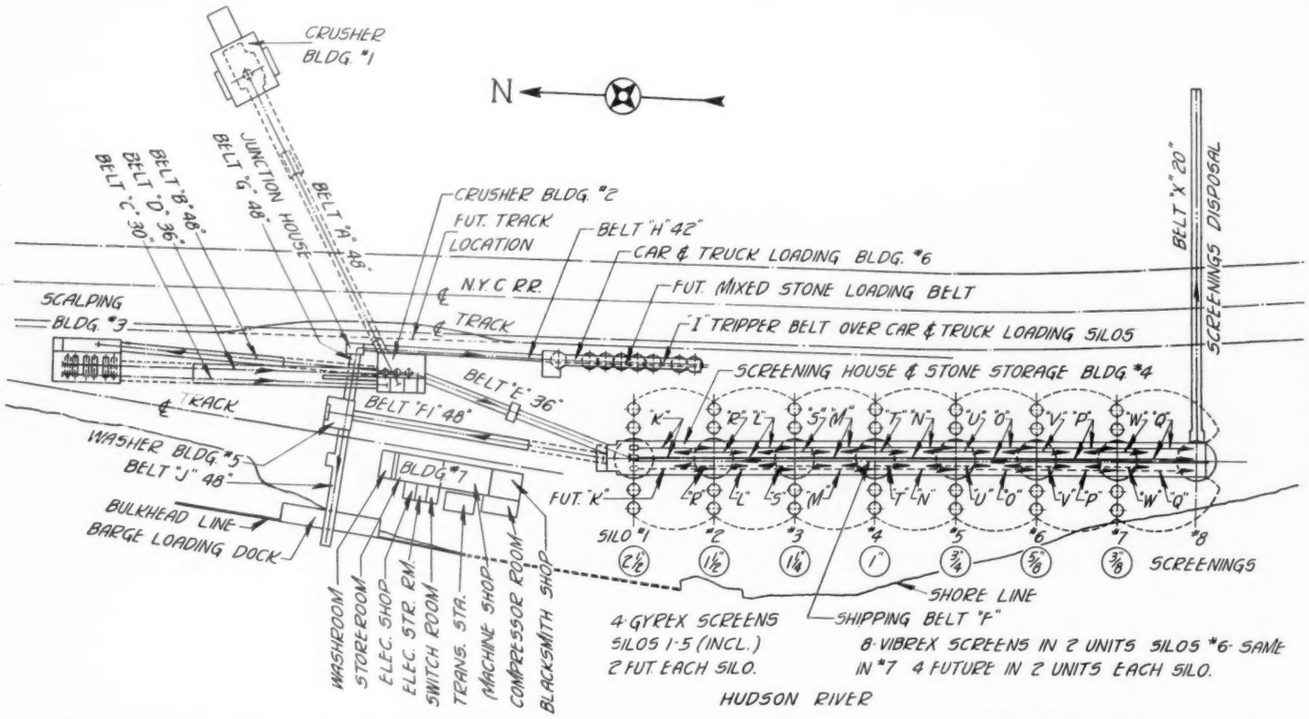
Each silo, from No. 1 to No. 5, inclusive, contains four Robins "Gyrex" screens, with provision for future installation of two additional screens in each. The "Gyrex" screens are driven by 5-hp. motors with Texrope drives.

Silos Nos. 6 and 7 each contains eight Robins "Vibrex" screens in four units, with provision for future installation for installing four additional screens in two units. The "Vibrex" screens are driven by 2-hp. motors with Texrope drives. Silo No. 8 is for screening less than ⅜-in. Under the silos, in the tunnel, is conveyor "F."

An interesting feature about this building is the small silo which forms a retaining wall for segregating the various sizes of stone in the outside storage. There is a total storage capacity of 142,000 cu. yd., of which 100,000 are reclaimable gravity and 42,000 by mechanical equipment.

A passenger elevator in the north end of the building, for reaching the conveyor or screen floors over the silos, has been installed.

A 3-ton P. and H. crane travels about 800 ft. along the entire length of the building. In this building are also located the drives



General ground plan of the new Clinton Point plant showing the location of the principal buildings and equipment

for conveyors "M" to "O" which are the belts between screening stations and also for conveyor "E" and conveyors "T," "U," "V" and "W," which are the transfer belts for the open storage between silos.

Screenings are taken from silo No. 8 by conveyor "X," which transports this material across the railroad tracks to a storage pile east of the plant.

Under the silos is a concrete tunnel with hoppers feeding conveyor "F," which draws stone either from the silos or the open storage between them and discharges on conveyor "F-1" which in turn discharges into the washing plant in No. 5 building.

Washing

The washer building, building No. 5, houses also the boiler and pump house and the drive for the "F-1" conveyor. The washer, of the company's design, consists of a series of baffles and spray pipes. Fresh water is pumped through the washer by a Cameron centrifugal pump, 300-g.p.m. capacity, driven by a 200-hp. Allis-Chalmers motor. The sand is pumped from the sump under the washer by a Morris centrifugal pump, 2800-g.p.m. capacity, driven by a 200-hp. Allis-Chalmers motor. A provision has been made for the future installation of one additional fresh water pump and one additional sand pump. The washer is of a design similar to the one developed by Wm. Berry, master mechanic of our Tomkins Cove plant, and is in successful operation in three of our other plants.

All stone is washed before shipped. From the washer the stone is discharged on a reversible conveyor "G." When loading barges, conveyor "G" discharges on conveyor "J." At the discharge of conveyor "J" there is a Robins tripper for automatically trimming the barges. The tripper is electrically operated by the same man who operates the barge pulling hoist. Provisions have been made for loading sea-going vessels outside of the main barge loading station.

The boiler in the No. 6 building supplies steam for heating the washer in freezing weather, and for heating the No. 7 building. The drive for conveyor "F-1" is also located in this building.

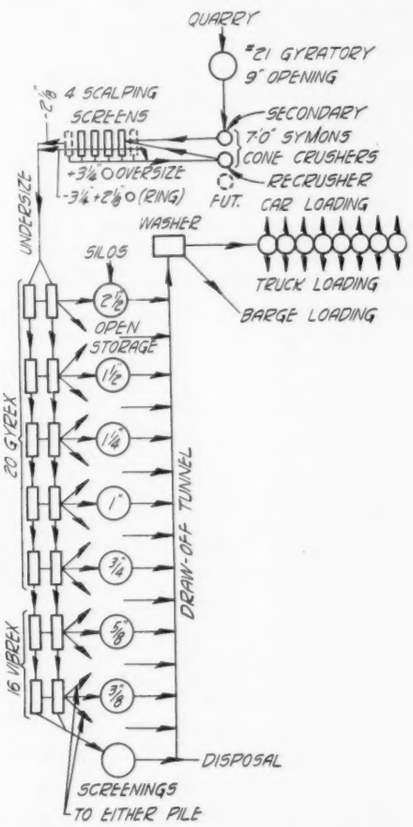
Auxiliary Buildings

When barges are not being loaded conveyor "G" runs in the opposite direction to a junction house, where the stone is transferred to conveyor "H," which in turn discharges onto belt "I." Conveyor "I" is a tripper belt which travels over the car and truck loading silos in building No. 6.

Stone may be loaded to either railroad cars on one side of the silo or to motor trucks on the other. A tunnel under this building has been provided for the possible future installation of a mixed stone loading belt.

At one end of this building is a 20-ton truck scale and on the railroad side is a 100-ton track scale. Both scale-beams are in the shipping office of this building and are operated by one man. Storage capacity of these silos is 3500 cu. yd.

An auxiliary building, No. 7, contains the office, store rooms, machine shops, blacksmith



Flow sheet of the New York Trap Rock Corp.'s new plant at Clinton Point, N. Y.

shop, compressor room, and electrical shops. This building, like other concrete buildings, is of the slip-form construction.

A 10-ton P. and H. crane travels the length of the store room, machine shop and blacksmith shop. A railroad siding runs into the shop from the south end. Outside of the building is the electrical sub-station.

Electrical Equipment

Power is furnished by the Central Hudson Gas and Electric Co., at 66,000-v., three-phase, 60 cycle, to the substation. Three banks of three-phase 1500-k.v.a. transformers reduce the voltage to 2300 for distribution throughout the entire plant. There will be a total connected load of 4500 hp. at the present time which will ultimately be increased to 6000 hp. Motors up to and including 25 hp. operate on 440-v., being supplied by a distribution transformer located in each building. All motors above this rating are 2300-v.

All of the important machinery is electrically interlocked so that it is impossible to start any piece of machinery in the system unless those ahead of it are running. This system is automatic so that in the event of a breakdown or stopping of any machinery, all of the machinery behind it will stop.

As an example, should there be a breakdown of the scalping screens in building No. 3, then the operator of those screens would stop the feeders to these screens. By so doing, he would automatically stop conveyor "B," the feeders to the secondary crusher in No. 2 building, the primary conveyor "A" and the truck dumping mechanism at the primary crusher. At the same time a red light would go on at the starting switch of these machines, warning the operators that the machinery ahead was stopped. The operator in No. 3 building would also push the signal button three times. This would blow electric horns in each of the buildings. The three signals thus given would notify the operators in the various buildings that something was wrong in building No. 3, and they would go there to give assistance. By this system, a plant as large as this one can be run with a minimum of mill repair workers.

Conveyors

One of the most interesting features of this plant is the extensive use of conveyors; there are 32, totaling 6528 ft. center to center, requiring a total of 1595 hp. to operate. The conveyor drives all consist of Falk Corp. herringbone reducers directly connected to the drive pulley by Falk flexible couplings. The power is supplied by Allis-Chalmers motors, types AR and ARY, 440-v., or 2300-v., 900 r.p.m. connected to the reducers by Falk flexible couplings.

Idlers and pulley were supplied by the Robins Conveying Belt Co. The 48-in. conveyors are five pulley, Timken equipped, on steel channel supports. All other troughing idlers are three pulley, Timken equipped. The return idlers are Schaefer equipped dead-shaft type. Rubber covered idlers are placed on the larger conveyors under the loading points. In most cases on the larger conveyors the take-ups are of the vertical roller gravity type. There are two Robins

DETAILS OF CONVEYORS AT THE NEW POINT CLINTON PLANT, NEW YORK TRAP ROCK CORP.

Conveyor	Belt, in.	Length, c. to c.	Capacity, tons	Motor, hp.	Speed reducer ratio
A	48	448	1200	200	36.6:1
B	48	430	1500	200	24.4:1
C	30	422	450	30	21.3:1
D	36	450	1000	150	18.8:1
E	36	301	1000	150	18.8:1
F	48	795	1500	75	24.4:1
F-1	48	370	1500	200	24.4:1
G	48	104	1500	20	21.3:1
H	42	316	1000	150	24.4:1
I	36	176	1000	30	21.3:1
J	48	108	1500	100	24.4:1
2 K	30	112	450 ea.	60	21.3:1
2 L	30	112	450 ea.	60	21.3:1
2 M	20	112	260 ea.	40	13.2:1
2 N	20	112	180 ea.	20	18.8:1
2 O	20	112	150 ea.	20	18.8:1
2 P	20	112	150 ea.	20	18.8:1
2 Q	20	108	130 ea.	10	21.3:1
R	30	98	450	5	21.3:1
S	20	98	260	5	13.2:1
T	20	98	130	5	21.3:1
U	20	98	130	5	21.3:1
V	20	98	130	5	21.3:1
W	20	98	130	5	21.3:1
X	20	460	300	30	21.3:1

Total amount of horsepower for all conveyors 1595

trippers, one over the car loading silos and one on the loading dock.

The essential details of these conveyors are given in the table on page 63.

The locations of the different conveyors are indicated on the general plan accompanying this article and their specific use mentioned in the preceding.

Design

The design of the new plant was carried out under the direction of Stirling Tomkins, vice-president of the New York Trap Rock Corp., in charge of operation, and by E. Lee Heidenreich, Jr., chief engineer of the New York Trap Rock Corp. A. C. Bruner and J. J. Carney of the Burrell Engineering and Construction Co., Chicago, made the general plans for which the details were later made.

The Burrell company made the detail plans and received the construction contract, including all buildings and conveyor bridges. Under a sub-contract, the Lackawanna Steel Construction Corp., Buffalo, N. Y., is fabricating and erecting the structural steel. The New York Trap Rock Corp. is excavating for all foundations and has purchased machinery and will erect same. The electrical work is being done by the New York Trap Rock Corp. under the supervision of L. F. Miller, its electrical engineer.

Piling for the dock and bulkhead was placed by Foley Brothers, Inc., of St. Paul, Minn. The construction superintendent for the New York Trap Rock Corp. is W. S. McHenry; for the Burrell company, Joseph Q. Taylor. This new plant marks the third which the Burrell company has built for the New York Trap Rock Corp.

Principal Equipment

The following is a list of the principal equipment to be installed and the manufacturers furnishing it:

Belts—Robins Conveying Belt Co.
Chutes—Schreiner Metal Products Co.
Conveyors—Robins Conveying Belt Co.
Cranes—Harnischfeger Sales Corp.
Crushers—Nordberg Manufacturing Co.
Electrical—Transformers, motors, Allis-Chalmers Mfg. Co.; switching equipment, General Electric Co.; sub-station, Westinghouse Electric and Mfg. Co.
Elevator—American Elevator and Machine Co.
Feeders—Traylor Mfg. Co.
Flexible couplings—Falk Corp.
Pumps—Cameron Steam Pump Co. and Morris Machine Works.
Reducers—Falk Corp.
Screens—"Gyrex," Robins Conveying Belt Co.; "Vibrex," Robins Conveying Belt Co.; revolving, Allis-Chalmers Mfg. Co.

History—General

In the year 1879 the property was purchased by Barnegat Lime Co., with the intention of manufacturing lime. Starting in the year 1880, the firm produced lime on a small scale until the year 1887. The following year, 1888, the property was taken over by the New York Brokenstone Co., who started producing crushed stone. The plant consisted of two No. 6 drop-bottom gate crushers and one No. 8 crusher.

Hand drills were used in quarrying the stone and horse carts were used to haul it to the crusher. The same method was used in loading of the scows and sailing smacks. (The horses were purchased from the street car department of New York City.) At present there are nine Keystone well drills, each operated by 15-hp. motors. For loading, there is one No. 36 Marion shovel, three No. 50-B Bucyrus-Eries, and one 100-B electric Bucyrus-Erie shovel.

Early Shipments by Scow

The stone was shipped on scows and small sailing smacks. The capacity of the smacks were 90 tons and the scows 200 tons. The output per day was 90 tons. It took one day to load a 90-ton smack and two and one-half days to load a 200-ton scow.

Tarrytown was the main shipping point, the smacks making the trip down from the plant to Tarrytown in two days and to New York City in four days. The sailing smacks made better time than the towing line.

In the year 1890 the New York Brokenstone Co. sold the plant to the Clinton Point Stone Co. At this time a new method was used in quarrying the stone. Steam drills were used for drilling and a steam dinkey was used in hauling the cars to the crusher. (The dinkey required a large gage track than the cars, which made it necessary to have four tracks, two for the dinkey and two for the cars.) The cars were drawn in a circle around the face of the quarry and men were stationed along the track to throw the stone into the cars. (Eighteen foremen were in charge of the men employed in the loading of the cars.)

Marked Expansion

In 1891 the plant was enlarged. The machinery was purchased from the Storm King Stone Co., which was located on Storm King Mountain opposite Storm King Lookout. In 1893 a set of rolls and a tramway were installed, costing $30,000. As this method was not successful, it was discontinued in favor of the old method of loading by hand. (The men were paid 10 cents a ton while loading the cars, and mules were used to haul the stone to the crusher.)

The name of the firm was changed in 1910 from the New York Brokenstone Co. to the Upper Hudson Stone Co. and at this time the Clinton Point plant was enlarged and the Cedarcliff Stone Co. plant purchased. In 1912 the No. 21 Allis-Chalmers crusher was installed, and two years later, 1914, the first steam shovel was installed (Marion No. 91), also two American locomotives.

The year 1915 was marked by the purchase of a Marion No. 110 shovel and two more locomotives. An Atlantic shovel and two locomotives were added in 1916. At this time well drills were used for primary drilling. Finally in 1919 the plant was sold to the New York Trap Rock Corp.

Foreign Cement Industry

THE BUREAU of Foreign and Domestic Commerce, U. S. Department of Commerce, has recently released a special cement bulletin in which some of the activities of foreign cement companies are reviewed. The following is taken in part from this bulletin:

Belgium. Cement industry in Belgium toward the close of 1929 reported active with most mills running at capacity. Of total cement imports to the United States, Belgium mills accounted for 62% in 1929, the Boston area receiving the greater part of this. The Los Angeles district is the largest American market for Belgian clinker.

Denmark. Development of new export markets and larger shipments to old markets has expanded the cement industry. Latest figures available (1928) indicate a production of 4,570,000 bbl., of which almost 3,000,000 was exported. Chief markets are South and Central America and Far Eastern countries; Brazil is the largest customer, with Columbia and Porto Rico next. The 1928 prices were constant, but in 1929 prices were cut 32 c. per bbl., so that the present price is $2.60 per bbl., f.o.b. stock Copenhagen. The "Dansk Cement Central," a co-operative sales organization comprising all Danish cement manufacturers except two, was formed in 1928 to take care of domestic sales.

The Aalborg portland cement plant, one of the most important cement plants in Denmark, has installed a new kiln capable of producing 1525 bbl. of cement per day. The daily capacity of the plant with its seven kilns now stands at 7550 bbl.

Portugal. There are three cement mills in this country, all located in the southern half. No production statistics are available.

New Zealand. Through the aid of a protective tariff on cement ($0.36 per 112 lb.), demand is met almost entirely by the domestic mill, the only one in New Zealand and known as Wilson's (N. Z.) Portland Cement, Ltd., near Whangarei. This plant is quite modern, situated close to raw materials, fuel, hydro-electric power and deep water port facilities. Production figures are unavailable, but shipment by water in 1928 totaled 672,289 bbl. The mill is now producing an early high strength cement, though white cement is still imported.

Spain. If portland cement production in Spain continues at its usual annual rate of increase, the total for 1930 will pass 11,728,000 bbl. Since domestic consumption would require that amount only under the most exceptional circumstances, it is possible that there will be an excess of production in 1930.

Syria. Construction work on the plant of the Societe des Ciments Linanais at Chekka near Tripoli was started and it is expected to be completed by the end of next year.

Yugoslavia. Production of cement in Yugoslavia during 1928 has recently been reported as 4,839,911 bbl. Of 14 plants in operation, three produced 3,109,679 bbl.

Multistage Process for Burning Portland Cement Clinker*

By Robert D. Pike
Emmeryville, Calif.

SOME large-scale experiments in multistage burning portland cement clinker as conducted by the writer have been described, and the following proposed multistage combinations have been analyzed quantitatively: (1) one calciner in series with one rotary, with rotary gas to the calciner; (2) two calciners in parallel, each in series with one rotary, with gas to the calciners; (3) two calciners in parallel, each in series with one rotary, but waste heat goes to boiler and a potash-recovery plant is included. The third arrangement has been shown to be the most efficient. The possibility of profitable collection of byproduct potash by means of this arrangement is discussed in detail.

A PROPOSAL for dividing the burning of portland cement clinker into stages so that calcining would be accomplished in one stage and clinkering in another is not new, and many variations of this idea occur in the literature. Reports have been received from Japan of the operation of the Hokkaido plant of the Asano Portland Cement Co. for the commercial burning of clinker from burned lime and clay. According to this information, the output of clinker from the rotary kiln is increased threefold by this procedure and the power for raw grinding cut in half.

During 1923 and 1924 the writer conducted large-scale experiments for the Santa Cruz Portland Cement Co. at its Davenport, Calif., plant in connection with a proposal of his, which subsequently came to be called the three-stage process (calcining-clinkering-regenerative cooling). This experiment, which cost more than $150,000, was made possible by the progressive foresight of George T. Cameron, president of the company. It proceeded far enough to bring conviction that the process was sound and that by its use a saving of about one-half in fuel consumption for burning clinker could be effected. This process makes possible a realization of the fuel economy of the shaft kiln combined with a large output per unit. At the time it was decided to undertake these experiments there was a shortage of fuel oil in California which promised to be serious, and the already high price of oil with prospects of still higher prices made the experiments timely. But during their course new oil fields were discovered and the deficiency of oil was turned into a surplus with a consequent great drop in price. Interest in these experiments therefore languished at the time when their results were about to be embodied into a commercial unit.

The writer has subsequently continued his studies of the theory of the process and of multistage burning in general and has redesigned the apparatus in view of the teachings of the Davenport experiment.

Apparatus for Three-Stage Process

Fig. 1 shows a side elevation of an arrangement of apparatus for carrying out the three-stage process. In this figure *a* represents a multiple-hearth calciner of a modified Herreshoff type fired with injected fuel over the bottom hearth. This calciner has 11 hearths and an internal diameter of 12 ft. The gas of combustion passes through a Cottrell precipitator, which returns the dust to the second hearth from the bottom. The hot calcines drop into a rotary feeder, *b*, of special design which transfers them directly to the rotary kiln, *c*. In this unit the rotary kiln is 75 ft. long, has an expanded lower end with an internal diameter of 7 ft. 6 in. and the internal diameter of the upper end is 5 ft. 6 in. The hot gas of combustion from the rotary passes into the calciner at a point a little above its mid-height. The hot clinker from the rotary drops into a regenerative cooler, *d*. Hot air for combustion passes directly from the regenerative cooler into the rotary and through the flue, *e*, into the calciner. The cooler illustrated is of the multiple-hearth, mechanically rabbled type, chosen because of its high thermal efficiency, but any desired type of cooler may be employed.

The basis of the design of the apparatus for the multistage processes discussed in this paper is the high thermal efficiency of the many-hearthed modified Herreshoff furnace. This furnace is more efficient as a calciner than the rotary kiln. It has about the same thermal efficiency as the shaft kiln but a larger output. The modified Herreshoff calciner for this process embodies special features of mechanical design which make it suitable for calcining raw mix or limestone, the principal ones being a rotating bottom

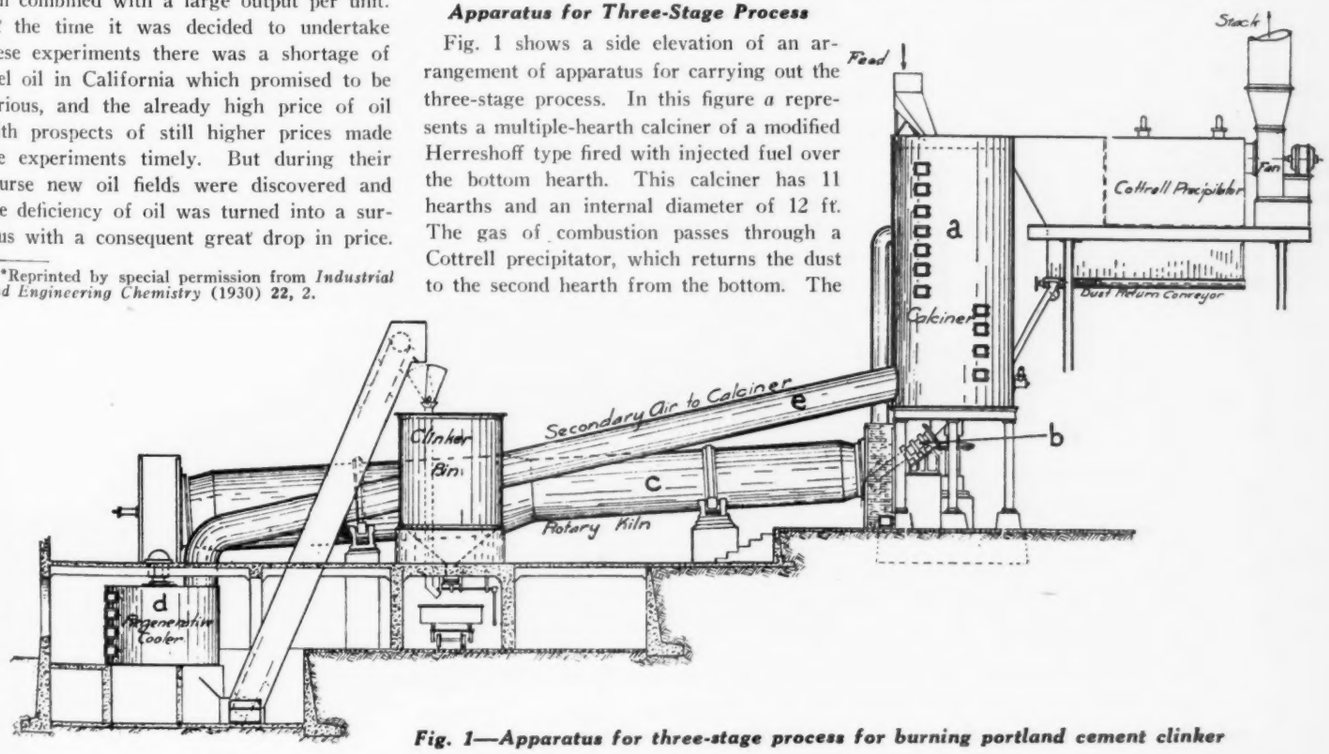


Fig. 1—Apparatus for three-stage process for burning portland cement clinker

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hearth and extra deep hearths for combustion chambers.

Modification of Original Arrangement

(1) Instead of using injected fuel in the calciner it may be replaced in whole or in part by broken solid fuel mixed with the material in the calciner. If the broken fuel is low in volatile, it may be mixed with the raw mix; if high in volatile, it should be stoked into the calciner on the hearth below the one over which the hot gas from the rotary enters. The experimental justification for this proposal is found in some work done by the writer and his associates in a co-operative research between the Berkeley, Calif., station of the U. S. Bureau of Mines and the Northwest Magnesite Co. (4), in which it was demonstrated that magnesite could be calcined in a multiple-hearth calciner by mixing with it about half the fuel requirements in the form of crushed coal. The remainder of the fuel was injected into the calciner. This method led to a high thermal efficiency and the general furnace temperature was lower than when all the fuel was injected.

(2) Two calciners may feed hot calcines to one rotary.

(3) The gas of combustion from the rotary, instead of passing into the calciner, may go directly to a waste-heat boiler. This arrangement is, in the writer's opinion, superior to the one illustrated in Fig. 1. In the first place it removes the necessity for the introduction of the hot gas from the rotary kiln into the calciner. To do so greatly increases the gas velocity through the upper ports, causing a corresponding increase in dust pick-up, and this gas has a propensity for forming incrustations on surfaces with which it comes into contact. Its removal from the calciner and utilization elsewhere is therefore a great advantage.

The gas leaves the rotary kiln at a temperature of about 2100 deg. F. and may be delivered to the waste-heat boiler at 1750 deg. F., resulting in a waste-heat boiler of high rating and high efficiency. In any event, the amount of steam to be generated in the waste-heat boiler is relatively small, only about 100 lb. per bbl. of clinker, so that its size for a given unit is small compared with waste-heat boilers attached to present-day rotary kilns.

Potash Collection at Davenport

Probably the most interesting result, however, of passing the rotary gas through a waste-heat boiler is the opportunity it affords for the efficient collection of potash as a byproduct. The essential elements of the successful collection of potash were worked out on a large scale by engineers connected with the Santa Cruz Portland Cement Co. at Davenport and the Western Precipitation Co. of Los Angeles. The potash-collecting plant has been described (1) but does not seem to have been accorded the attention which is deserved by an accomplishment of such great magnitude. A brief description of this process is included here because its principal steps can be adapted to the efficient collection of potash in connection with the multistage process.

The collection of potash at Davenport was no experiment but a full-sized plant connected up with 10 kilns which produced a total of 4500 bbl. of clinker daily. The potash plant was in practically 100% continuous operation from March 2, 1920, to May 24, 1924. It was erected directly back of the kilns and the entire flow of gas from the kilns passed into the plant.

The gas first passed downward through a spray tower associated with each kiln, where the major part of the dust was removed by water sprays. An essential feature of the process was that practically no potash fume was wetted by the sprays but the cooled and humidified gas which left the bottom of the tower contained all of the potash fume.

The slurry from the towers passed to a settling and decanting plant whose function it was to return to each kiln its proportionate amount of thickened slurry and to return most of the water in circulation to the spray towers. This wet stage of the process caused a lot of trouble. The water was saturated with calcium sulfate, which deposited as gypsum in hard layers in pipes and nozzles. It was very difficult to return the pro-rata amount of thickened slurry to the kiln and this material reduced somewhat the output of the dry-process kilns.

The gas leaving the bottom of the towers passed directly to the Cottrell precipitators, which were of a specially designed plate type. The potash fume was precipitated in a flocculent form on to a moving belt, which dropped the light material through rolls which compacted it and dropped it into bags which were ready for shipment. This part of the process worked perfectly and almost automatically. The only hand labor required was the placing and removing of the bags, but these operations could have been completely mechanized. The salt produced contained on the average 31 to 32% K_2O as sulfate and about one ton was produced per kiln per day. This yield was therefore about 1.5 lb. of K_2O per bbl. of cement, and as K_2O in this form is worth about $0.04 per lb. the gross return was $0.06 per bbl.

Process with Waste-Heat Boiler and Potash-Collecting Plant

Fig. 2 shows the arrangement of the three-stage process with waste-heat boiler and potash-collecting plant. Data presented by the U. S. Department of Agriculture (5) indicate that it should be possible to collect an average of 1.75 lb. of K_2O per bbl. of clinker, and the results obtained at Davenport are slightly below this figure. The raw

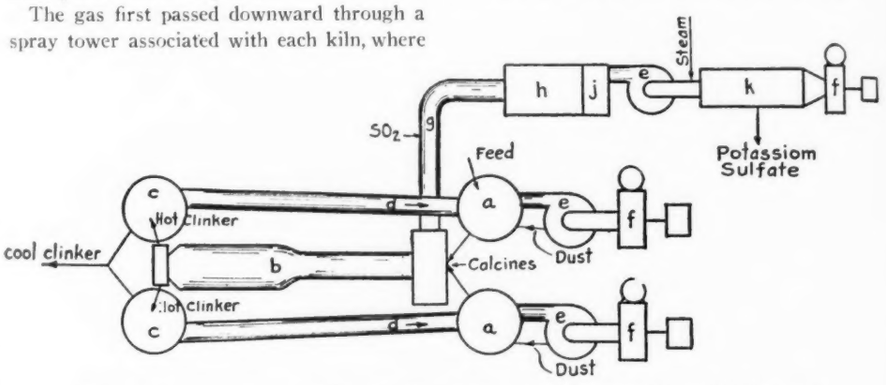


Fig. 2—Arrangement of three-stage process with waste-heat boiler and potash plant

Key—a-a, Herreshoff-Pike calciners; b, rotary kiln; c-c, regenerative coolers; d-d, flues for hot combustion air; e-e-e, dust collectors; f-f-f, exhaust fans; g, flue; h, waste-heat boiler; j, economizer; k, Cottrell precipitator for collecting potash.

mix at Davenport contained on the average 0.78% K_2O and the clinker, 0.44%.

With the above explanation in mind, Fig. 2 will be almost self-explanatory, but a few points need mention. At Davenport the fuel oil contains about 0.75% sulfur and all this sulfur goes to the potash plant. In the arrangement shown in Fig. 2 using the same kind of fuel as at Davenport, less than one-fifth the amount of sulfur will go into the flue to the waste-heat boiler. This fact leads to some question as to whether there will be enough sulfur dioxide to sulfate all of the K_2O and CaO present in the gas. In anticipation of the possibility of a shortage of sulfur, Fig. 2 shows the introduction of sulfur dioxide into the flue. The concentration of potash fume in the gas going to the potash plant will be at least five times as great as in the gas at Davenport. On this account it is unnecessary to wash the gases before they go to the precipitator, but a dry dust collector should be sufficient. Before entering the precipitator the gas is humidified. A commercial grade of potassium sulfate should be directly obtainable from the precipitator, and the efficiency of collection would be considerably higher than at Davenport because of the greater concentration of potash fume in the gas. The precipitator can be designed easily for 95% efficiency which, based upon the data given above, would yield an average of 1.75 lb. of K_2O per bbl. of clinker, worth $0.07 per bbl. On the assumption of an op-

erating cost of $0.015 per bbl., this would mean a net return of about $0.055 per bbl.

This description shows that the wet part of the process, which alone gave trouble at Davenport, has been entirely eliminated, leaving a very simple automatic process. Also the great objection that is inherent in the extreme dilution of the fume has been removed, because all the potash fume is associated with one-third of the gases of combustion the total of which is only about one-half that obtaining at Davenport. Thus the high thermal efficiency of the three-stage process combined with separate treatment of the gases from the rotary makes possible the efficient and automatic collection of potash. To such potash the term "byproduct" would be correctly applied.

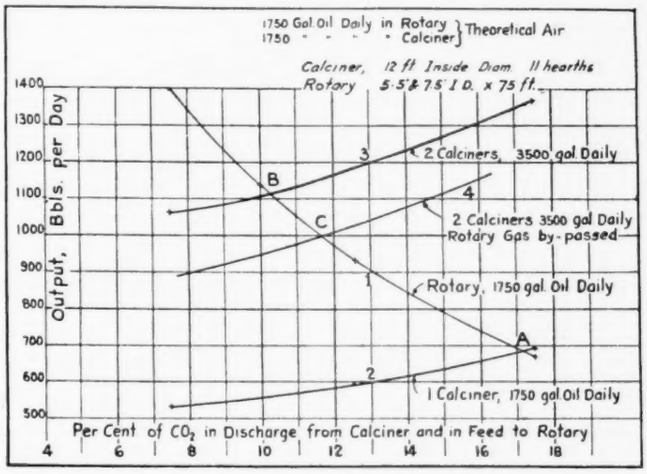


Fig. 3—Output vs. percentage of carbon dioxide in calciner discharge and rotary feed for three-stage process

Calculation of Heat Balances

The curves of Fig. 3 serve to define the principal characteristics of the arrangements described. In following out the calculations a constant rate of firing is assumed in the rotary and calciner. Each of these units of the size specified is fired with 1750 gal. of oil per day of 150,000 B.t.u. per gal. or equivalent of other fuel. Theoretical air is assumed. Under the stipulated conditions, curve 1 shows the variations of output of the rotary with varying percentages of carbon dioxide in the rotary feed. The experiments at Davenport showed that when discharged at 1600-1700 deg. F the calcines from the modified Herreshoff calciner contained from 10 to 17% carbon dioxide. The same conclusion might be drawn from a recent article (2). Therefore, a constant temperature of 1700 deg. F. in the rotary feed has been assumed. An interesting characteristic is the very rapid increase of output of the rotary as carbon dioxide in the feed to it decreases.

Curve 2 shows the variation in output of one calciner with per cent. carbon dioxide in the calcines. This curve assumes that the hot gas from the rotary goes into the calciner. Curves 1 and 2 intersect at *A*, which shows the output when one calciner is operated in series with the one rotary. The location of *A* also shows that the calcines will contain about 17% carbon dioxide. The output is 670 bbl. daily; fuel, 3500 gal.; B.t.u. per bbl., 782,000.

Curve 3 is for the two calciners and each ordinate is simply twice as high as the corresponding ordinate for curve 2. Curves 1 and 3 intersect at *B*, which point corresponds to two calciners operating in parallel, each in series with the one rotary. All the gas from the rotary goes into the calciners. The calcines contain 10.3% carbon dioxide. The output is 1120 bbl. daily; fuel consumption, 5250 gal. of oil; B.t.u. per bbl., 703,000.

Curve 4 is for two calciners and is the same as curve 3 except that none of the gas from the rotary goes into the calciners. Curves 4 and 1 intersect at *C*, showing 11.7% carbon dioxide in the calcines, an output of 1000 bbl. daily, and a fuel consumption of 788,000 B.t.u. per bbl. Table II shows a credit of 103,000 B.t.u. in waste-heat steam, so that when the waste-heat boiler is taken into consideration point *C* has a somewhat higher efficiency than point *B*.

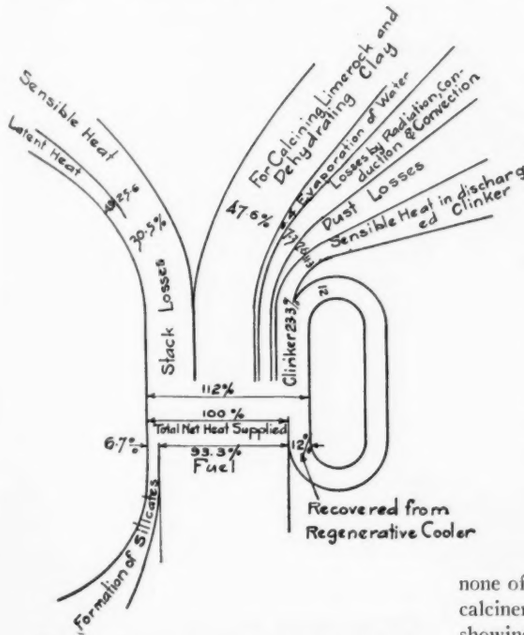


Fig. 4—Diagram of heat distribution in burning portland cement clinker by three-stage process corresponding to point A, Fig. 3

It will be noted that the sizes of units chosen for the above analysis are relatively small. This has been done in order to present data for a practical test unit. In practice, units at least twice as large can be built producing about 2000 bbl. of clinker daily.

Table I and Fig. 4 give a heat balance corresponding to the point *A*, Fig. 3.

Table II gives the heat balance corresponding to point *C*, Fig. 3.

TABLE I—CALCULATED HEAT BALANCE OF THREE-STAGE PROCESS FOR BURNING PORTLAND CEMENT CLINKER WITH ONE CALCINER IN SERIES WITH ONE ROTARY, AND WITH ROTARY GAS GOING INTO CALCINER

Carbon dioxide in mix from calciner to rotary, 17.2%.
Principal dimensions of calciner, 12 ft. dia. by 11 hearths.
Principal dimensions of rotary, 5 ft. 6 in. by 7 ft. 6 in. dia. by 75 ft. long.
Daily clinker output, 680 bbl.
Fuel consumption, 772,000 B.t.u. per bbl.

	B.t.u. per bbl. Debit	Credit	Pct.
Heat in fuel	772,000		
Heat of formation of silicates 153 B.t.u. per lb.	55,800		
Sensible heat in stack gases at 908 deg. F., m.s.h. 0.27, 2.53 lb. per lb. clinker		212,000	25.6
Latent heat in same		40,600	4.9
Heat for calcining lime rock and dehydrating clay 1080 B.t.u. per lb.		394,000	47.6
Heat for evaporating water of raw mix		3,100	0.4
Sensible heat of discharged clinker		96,000	11.6
Heat lost with dust		21,200	2.6
Losses by radiation, convection, and conduction from outside surface		60,900	7.3
	827,800	827,800	100.0

TABLE II—CALCULATED HEAT BALANCE OF THREE-STAGE PROCESS FOR BURNING PORTLAND CEMENT CLINKER WITH GAS OF COMBUSTION FROM ROTARY BY-PASSED THROUGH A WASTE-HEAT BOILER

Carbon dioxide in mix from calciner to rotary, 11%.
Temperature of mix from calciner to rotary, 1700 deg. F.
Number of modified Herreschoff calciners, 2.
Principal dimensions, 12 ft. dia. by 11 hearths.
Number of rotaries, 1.
Principal dimensions of rotary, 5 ft. 6 in. by 7 ft. 6 in. dia. by 75 ft. long.
Number of coolers of Herreshoff type, 2.
Principal dimensions not stated; instead, one rotary cooler may be employed if desired.
Daily clinker output, 1060 bbl.
Fuel consumption, 788,000 B.t.u. per bbl.
Heat in steam from waste-heat boiler, 103,000 B.t.u. per bbl.

	B.t.u. per bbl. Debit	Credit	Pct.
Heat in fuel	788,000		
Heat of formation of silicates, 153 B.t.u. per lb.	55,800		
Sensible heat in stack gas from calciner at 500 deg. F., m.s.h. 0.27, 1.63 lb. per lb. clinker		78,200	9.26
Sensible heat in stack gas from waste-heat boiler at 450 deg. F., m.s.h. 0.27, 0.89 per lb. clinker		34,200	4.05
Latent heat in all stack gases		39,100	4.63
Heat for calcining lime rock and dehydrating clay, 1080 B.t.u. per lb.		394,000	46.75
Heat in steam from waste-heat boiler		103,000	12.20
Heat for evaporating water of raw mix		3,100	0.37
Sensible heat of discharged clinker		96,000	11.35
Heat lost with dust		21,200	2.51
Losses by radiation, convection, and conduction from outside surface		75,000	8.88
	843,800	843,800	100.00

Davenport Experiment

In the Davenport three-stage process experimental plant the calciner was a modified Herreshoff furnace having 11 hearths and an internal diameter of 12 ft. 6 in. The rotary was 35 ft. long and had an internal diameter of 3 ft. 6 in. The regenerative cooler was a modified Herreshoff furnace with four hearths and an internal diameter of 11 ft. Fig. 5 shows a part of this plant.

In designing this first plant the writer established as criteria complete calcination of the raw mix in the calciner and the use of a very small rotary whose function would be solely that of clinkering. This proved to be a fundamental error, because such a balance between the calciner and the rotary proved to be impossible to maintain. When the calciner was set to produce complete calcination, it was found that the material on the bottom hearth was in an unstable condition causing semi-clinkering and a stoppage of the feed. When the calciner was operated to discharge calcines at 1700 deg. F. with 10% or more carbon dioxide, no operating difficulties were encountered, but under these conditions the rotary was so small that clinker could not be produced in sufficient quantity. These conditions have been remedied by use of a larger rotary as shown in Fig. 1 and by the production of calcines having from 10 to 17% carbon dioxide as shown in Fig. 3. When so designed the three-stage process can be operated without mechanical difficulties.

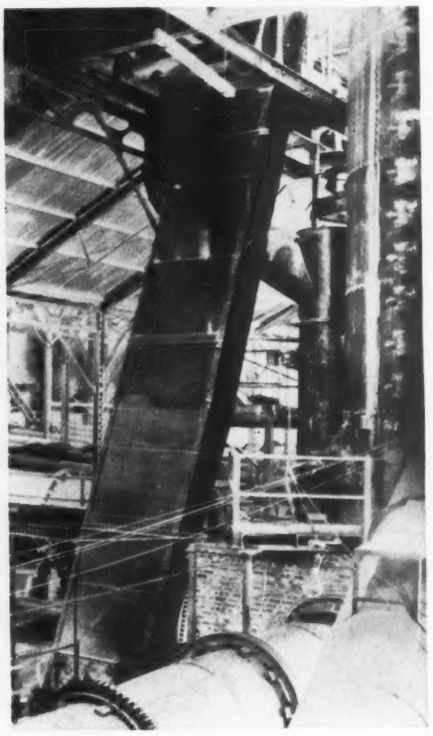


Fig. 5. Davenport experimental plant for three-stage burning process

The Davenport experiment furnished data for rational design of the three-stage process and demonstrated the high efficiency of the modified Herreshoff furnace for partially calcining raw mix. It was found that calcines could be discharged at 1600-1700 deg. F. with 10 to 17% of carbon dioxide without running into incipient clinkering. When producing such calcines there will be no difficulty in operating with stack gas at 500 deg. F.

Complete Separation of Calcining and Clinkering Stages

A somewhat different interpretation can be given to the arrangement for multistage burning. This proposed arrangement contemplates calcining crushed limestone to practically zero carbon dioxide in the modified Herreshoff calciner, cooling and mixing the lime with clay, and burning the mixture to clinker in a rotary kiln. This is virtually the scheme which has been used in Japan, except that the many-hearthed calciner with its large unit output combined with high fuel economy has been substituted for the shaft kiln for calcining the lime rock. Obviously this arrangement, which is illustrated diagrammatically in Fig. 6, is inferior with respect to fuel economy to the one illustrated in Fig. 2. If it is assumed for the purpose of convenient calculation that the cement raw mix is made up of 75% pure lime rock and 25% of clay, the amount of material to be fine ground, if the pure lime rock is first calcined, is reduced by about one-third and burned lime is easier to grind than lime rock. A probable saving of about one-half in power used for raw grinding may therefore be expected, and this is the saving actually reported from Japan.

Table III gives the calculated heat balance of a rotary kiln used to burn clinker from a mixture of lime and clay.

The modified Herreshoff calciner will calcine a ton of lime rock with the expenditure of about 5,500,000 B.t.u. One barrel of clinker will require 245 lb. of 98% burned lime (assuming no dust loss): therefore one ton of such lime will produce 8.16 bbl. of clinker at an expenditure of 644,000 B.t.u. per bbl. The total B.t.u. required per bbl. of clinker will then be 1,021,350, or 347,350 B.t.u. in rotary plus 674,000 B.t.u. in calciner.

Comparison of Proposed Arrangements

Table IV summarizes the most important characteristics of the proposed arrangements.

The arrangements summarized in columns 3 and 4 seem to be the most interesting. The most apparent difference between them is that a saving of 336,000 B.t.u. is balanced off against whatever saving may be effected in the cost of grinding the raw material resulting from having a third less material to grind and that of an easier grinding nature. It is not the purpose of this paper to discuss in detail what this saving in grinding cost

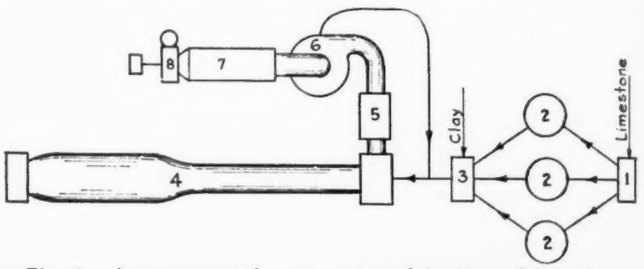


Fig. 6—Arrangement for separate calcination of limestone

Key—1, coarse crushing plant; 2, modified Herreshoff calciners; 3, fine grinding plant; 4, rotary kilns; 5, cooling and humidifying chamber; 6, dry dust collector; 7, Cottrell precipitator for potash salts; 8, exhaust fan.

TABLE III—CALCULATED HEAT BALANCE FOR ROTARY KILN BURNING A MIXTURE OF LIME AND CLAY

	B.t.u. per bbl. clinker	
	Debit	Credit
Heat in fuel	347,350*	
Heat of formation of silicates	55,800	
Sensible heat in stack gases at 1074 deg. F., m.s.h. 0.27, 0.79 lb. per lb. clinker		79,000
Latent heat in same		16,250
Heat for dehydrating clay, 149 B.t.u. per lb.		54,400
Sensible heat of discharged clinker		155,500
Heat lost with dust		20,000
Heat lost by radiation, etc.		78,000
	403,150	403,150

*According to the meager data of the Japanese operation, the output of a rotary kiln is increased threefold and 49 lb. of coal are used per bbl. of clinker. Unfortunately no data are at hand on the quality of coal, but if this is 12,000 B.t.u. per lb. the consumption would be 588,000 B.t.u. per bbl. In such case the Japanese kilns were evidently operated with a higher stack gas temperature than postulated here, but it would seem to be reasonable to expect a temperature as low as that assumed if the output of the kiln were reduced somewhat as compared with the Japanese practice.

TABLE IV—SUMMARY OF DATA ON PROPOSED MULTISTAGE COMBINATION

	(1)	(2)	(3)	(4)
B.t.u. in fuel fired to burn clinker, per bbl.	772,000	703,000	788,000	1,021,000
B.t.u. in waste-heat steam, per bbl.	.....	.....	103,000	Rotary gas temp. too low to allow profitable steam generation
Net B.t.u. per bbl.	772,000	703,000	685,000	1,021,000
Potash recovery, lb. per bbl.	Could be collected from gas from calciner but not to as good advantage as in (2), (3) and (4)	1.75	1.75	1.75
Raw grinding	Normal	Normal	Normal	Limestone crushed, mixed with clay and ground; possible saving half cost of raw grinding

(1) One calciner in series with one rotary. Rotary gas to calciner.
(2) Two calciners in parallel, each in service with one rotary. Rotary gas to calciner.
(3) Same as (2) except rotary gas to waste heat boiler and potash recovery plant.
(4) Crushed lime rock completely calcined in modified Herreshoff, mixed with clay, ground and burned to clinker in rotary.

may be. Apparently the basic elements which should lead to a considerable saving are present, but a change in plant arrangement and usual methods of grinding would have to be made to take advantage of them. However, it is unlikely that the saving in cost of raw grinding, when considering the extra handling involved, could be more than $0.03 to $0.05 per bbl., and 336,000 B.t.u. is worth $0.052 when coal containing 13,000 B.t.u. per lb. is worth $4 per net ton at the kiln. Thus, the apparent economic facts indicate the arrangement represented in column 3 to be superior to that in column 4. A further very important advantage in the arrangement of Fig. 2 (column 3) is that the conditions in the calciner are much easier than in Fig. 6 (column 4). The arrangement shown calls for 11.7% carbon dioxide in the calcines, but by making the rotary larger this can be increased to as much as 17% with very little increase in fuel consumption. The modified Herreshoff will operate to its best advantage under these conditions of moderate temperature and partial calcination and the output for a given unit in terms of barrels clinker produced daily will be far greater than when the complete calcination of limestone is required, as in Fig. 6.

Comparison with Usual Rotary Kiln

Assuming, therefore, that the arrangement shown in Fig. 2 is the best, it will be of interest to compare this with a modern rotary using the dry process and equipped with waste-heat boilers. The comparison is hardly fair to the new proposed arrangement, because the waste-heat boilers in the usual rotary kiln plant are far larger than in the proposed plant.

In an earlier paper (3) it is shown that if 1,450,000 B.t.u. per bbl. are consumed in the dry-process kiln, the sensible heat in the exit gas will be about 700,000 Bt.u. Allowing for a waste-heat boiler efficiency of 60%, this will give 420,000 B.t.u. in the steam, leaving a net fuel consumption of 1,450,000 − 420,000 = 1,030,000. From this the estimated saving due to the arrangement of Fig. 2 with two modified Herreshoff calciners in parallel, each in series with one rotary, as compared with the usual waste-heat boiler rotary-kiln combination, is as follows:

B.t.u. per bbl. clinker (1,030,000 − 685,000)	345,000
Value based on coal of 13,000 B.t.u. per pound at $4 per ton at kiln	$0.053
Estimated net value of potash made possible by arrangement of Fig. 2	0.050
Total estimated saving per barrel	$0.103

Obviously no discussion of the economic features can be closed without the presentation of figures on cost of plant. As yet no exact figures are available, but rough estimates show that no great, if any, increase in first cost may be expected for installing the new arrangement when compared with the usual waste-heat boiler rotary-kiln combination.

Literature Cited

(1) Krorup, *Chem. Met. Eng.*, **25,** 316 (1921).

(2) Kühl, *Zement*, **17,** 1303 (1928); *Concrete*, **35,** 123 (1929).

(3) Pike, *Ind. Eng. Chem.*, **21,** 307 (1929).

(4) Ralston, Pike and Duschak, Bur. Mines, *Bull.* **236,**

(5) Ross, Merz and Wagner, U. S. Dept. Agr., *Bull.* **572,**

An Odd Patent Decision! Washing Oyster Shells After Crushing Is Patentable!

THE BOARD OF APPEALS of the United States Patent Office has held that the process of manufacturing concrete by crushing and soaking oyster shells in water before mixing them with cement and water is patentable, although the prior art shows concrete formed by mixing crushed shells, cement and water, where the applicant's procedure, as shown by affidavit, produced a new and improved concrete differing from that of the prior art.

In his affidavit the applicant stated that he has found from experiments that where the oyster shells were not thoroughly washed after being crushed, other conditions being the same, he was unable to secure a suitable hard durable concrete. When the oyster shells were crushed and then washed, he was able to obtain a product which is light, hard and durable and which can be sawed and nailed, he stated.

Opinion of the Board

This is an appeal from the action of the examiner finally rejecting claims 1 to 5. Claim 2 is illustrative, and is as follows:

"2. A process for forming concrete comprising first the crushing of oyster shells, then soaking them in fresh water, then drying them and then mixing them with suitable cement and water to form a concrete composition."

The reference relied on is: Palmer (British), 21161, of 1912.

The invention relates to a concrete composition formed of oyster shells and cement, and to the process of making the composition. Claims 1 to 4, inclusive, are drawn to the process, and claim 5 is drawn to the composition.

In carrying out the process the shells are first crushed and they are then soaked for several hours in fresh water. They are next separated from the water and dried, after which they are mixed with cement and water to form the composition.

Evolved From Experiments

In the Palmer patent a concrete is formed by mixing crushed shells, cement and water. The patent states that the shells are thoroughly cleansed from secretion, and the examiner holds that this is the full equivalent of the soaking step practiced by appellant, and that it is immaterial whether the cleansing or soaking step be performed before or after the shells are crushed.

Appellant has filed an affidavit in which he states that he has made many experiments in the mixing of concrete containing crushed oyster shells; that he has found from these experiments that where the oyster shells were not thoroughly washed after being crushed, other conditions being the same, he was unable to secure a suitably hard, durable concrete; and that when the oyster shells were crushed and then washed he was able to obtain a product which is light, hard and durable and which can be sawed and nailed. The affidavit states that appellant can not explain why the soaking and washing of oyster shells, after they are crushed, produces a better body of shell concrete than when the shells are merely washed before the crushing operation, but that this is nevertheless true. The original specification states that "the fresh water used in preparing the shells probably removes some soluble salt or salts, although I am not sure of the actual action."

Allowed Over Prior Art

The reference does not disclose the succession of steps recited in the claims. We believe it would not be obvious from the disclosure in the reference that a superior concrete would be formed if the shells were first crushed and then soaked. The claims are deemed patentable over the cited art.

The decision of the examiner is reversed.

Welded Pipe Design

A SHORT TIME ago the Linde Air Products Co., New York, published a booklet entitled "Design Standards for Oxwelded Steel and Wrought Iron Piping," intended for the use of engineers and architects in designing oxy-acetylene welded piping systems in accordance with recognized practice. This publication has been supplemented by "Fabrication of Welded Piping Designs," intended for the use of the executive, welder foreman and welder to enable them to properly execute and combine the fundamental designs described in the first booklet.

The publication gives in detail the correct procedure to be followed in making welded line joints and fittings. Methods of laying out templets for cutting out fittings from standard pipe by the oxy-acetylene process are completely covered. Tables for estimating costs are also given. It should be of particular interest to those engaged in the actual construction of welded piping systems. Copies are available through district offices of the Linde Air Products Co., located in principal cities.

Small But Efficient Crushing Plant in the Blue Grass Country

New Crushing Plant of Central Rock Co., Inc., Lexington, Kentucky

THE STONE quarries on the old Frankfort Pike near Lexington, Ky., were for years a source of dimension stone. They were operated irregularly on a small scale, for the demand was local and necessarily limited. Thus the quarry at the present time can be considered to be in the development stage, although sufficient rock has been taken out to expose a face about 30 ft. high carrying about 18 in. of soil overburden. The Central Rock Co., Inc., operators of the quarry, leases 38 acres of limestone-bearing ground at the quarry site.

Late in 1929 the Central company built a 500-ton-per-day crushing and screening plant designed by the Smith Engineering Works of Milwaukee, Wis., which company also supplied the crushing, elevating and screening equipment throughout. All of the different units in the plant are belt-driven from General Electric motors except where Texrope drives are used on the two crushers.

Central Rock Co.'s plant near Lexington, Ky., a modern small scale crushing operation

Drilling and Excavating

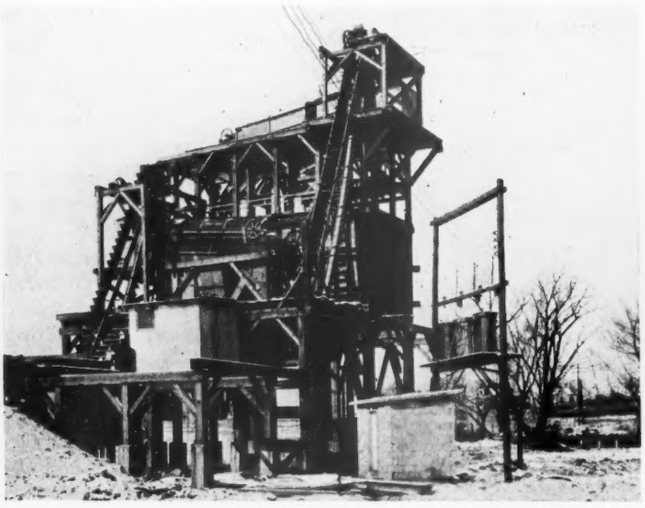
An Ingersoll-Rand wagon drill on which is mounted an X-71 air drill is used for primary drilling. Air for drilling is supplied by an Ingersoll-Rand XRB, two-stage, Imperial type, 490 c.f.m. compressor belt connected to a 75-hp. General Electric synchronous motor. An Ingersoll-Rand oil furnace and drill sharpener is also part of the shop equipment.

On the quarry floor a 1-cu. yd. Northwest gasoline shovel mounted on crawler treads loads the "Iron Mules" which transport the stone from the quarry to the crusher. The Iron Mule is the trade name of a special 2-cu. yd. front-dump body made by the Hughes-Keenan Co., Mansfield, Ohio; it is mounted on a McCormick-Deering tractor. The company has two of these trucks in use.

The loaded trucks run up a short dirt-fill ramp and dump to the 13-A Telsmith primary crusher. Discharge of this crusher is to a No. 6 bucket elevator of the same make, serving a 48-in. by 12-ft. rotary scalper; the first 4-ft. scalping section has 2½-in. round perforations and the two end sections 1¾-in. round holes. Oversize falls to a No. 40 Telsmith reduction crusher and the 2½-in. size can also be chuted to this reduction crusher if desired or it can fall along with the minus 1½-in. stone and the discharge material from the reduction crusher to the boot of a second No. 6 bucket elevator serving the rotary sizing screen.

Screening

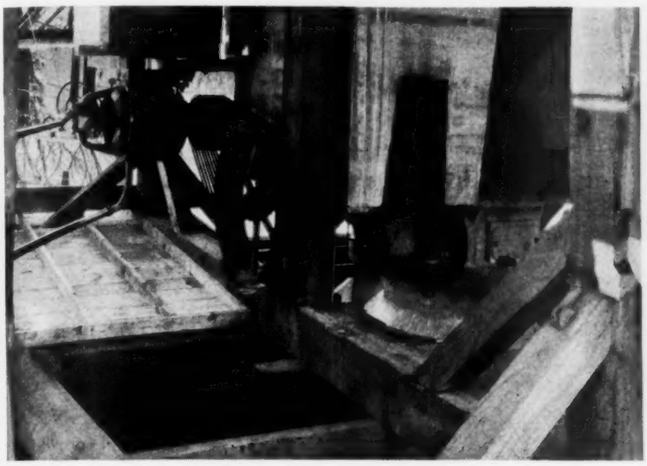
The single Telsmith sizing screen, mounted



Side view of the plant showing the screening equipment

Stone from the quarry to the crusher is carried in these 2-cu. yd. trucks

over the bins, is a 48-in. by 22-ft. rotary with a 6-ft. dust jacket of ¼-in. square openings. The main barrel of the screen has two sections of ¾-in., two succeeding sections of 1¾-in. and an end section of 2¾-in. round perforations. Fines from the dust jacket fall to a No. 36 double decked Telsmith vibrating screen for the production of the finer sizes. The stone from the screens drops to any of the six storage bins below. Sizes regularly produced are from 2½-in. down to dust. No washing is done.



Secondary crusher and its short center rope drive

The plant is of timber construction and built in the open with all the operation motors protected from the weather or in "dog houses." It is equipped for truck and railroad car loading, and early in 1930 the company expects to run a switching track from the L. & N. tracks to the bunkers for railroad shipments. A maximum of 15 men, including the superintendent, is required to operate the quarry and plant. All power is purchased and comes in to the plant at 220-v.

MOTOR SCHEDULE, CENTRAL ROCK CO., LEXINGTON, KY.

Location	Type	Hp.	Drive
Air compressor	Synchronous	75	Belted
Primary crusher	Slip ring	50	Texrope
Reduction crusher	Slip ring	50	Texrope
Scalper screen	Squirrel cage	10	Belted
Finishing screen	Squirrel cage	15	Belted
Vibrator screen	Squirrel cage	3	Belted
Elevator No. 1	Squirrel cage	15	Belted
Elevator No. 2	Squirrel cage	15	Belted
Total		233 hp.	

The company has a neat and attractive office of cut stone near the crushing plant. T. W. Havely is president of the new company, E. W. Ripy, vice-president, and W. B. Isaacs, secretary and treasurer. J. S. Morton is superintendent.

Products Plant Operated as a Sideline

The company also operates a concrete products plant as a subsidiary under the name of the Lexington Concrete Products Co. Plant and office are on Liberty Pike east of Lexington. This plant was built in 1929 also.

The crushed stone aggregate and sacked cement is dumped to a 21-cu. ft. Ideal mixer that sets at about the floor line of the plant. The mixer discharges the concrete to a skip that elevates the material over the wooden bins serving the two block machines. The skip runs on a monorail over these bins, dumping to either. This feature of the plant is quite novel and was worked out by the operating officers of the company.

Specially designed Anchor convertible tile and stripper machines are used, one for manufacturing concrete tile and the second for production of face tile. In a separate room is a second 9-cu. ft. mixer and molds for casting concrete specialties and art stone.

The green tile are placed on trucks running on an industrial track and are then moved over a transfer track to the two tunnel kilns for steam curing.

At present building blocks and tile culverts, drain tile, fence posts, floor tile, roof tile and special ornamental shapes are being made. Room has been provided for installing a sewer pipe machine at a later time. The plant has a daily capacity of 1500 block and 3700 tile, of which 700 are face tile.

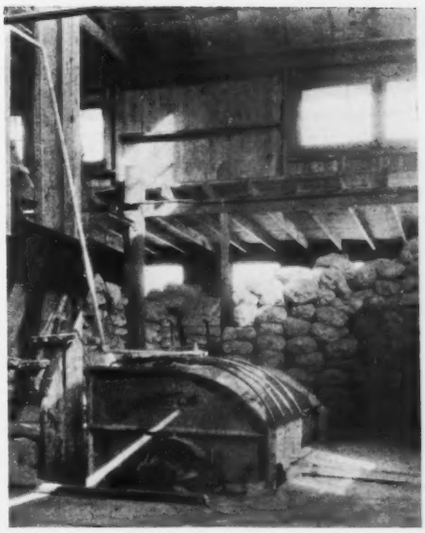
W. B. Isaacs is president of the Lexington Concrete Products Co., Silas Wilson, vice-president, and T. W. Havely, secretary and treasurer.

Unique Engineering Service

THE STURTEVANT Engineers, Inc., has been inaugurated to take over the entire engineering activities of the Sturtevant Mill Co., Boston.

This new concern has adopted an entirely new policy and a unique plan of engineering service, which places engineering on a similar basis to that of a machine and is sold in a similar manner. It involves proof that the project is sound before any charge is made; it proves the capability of the engineers, and facts and figures showing that a profit will result from their service before the engineers can profit. It also contemplates a definite price for engineering quoted in advance of employment. Thus clients are in a position to know the cost and results, within close limits, of a project and the ability of the engineers before they commit themselves to a major expenditure.

This is the first time engineering has been offered on approval and at a predetermined cost. It offers great possibilities to those who do not regularly employ their own engineers, and it also offers those having an engineering organization an opportunity to check their own ideas and conclusions for a very modest expenditure, thereby reinforcing their own knowledge with the outside experience of equally competent engineers.

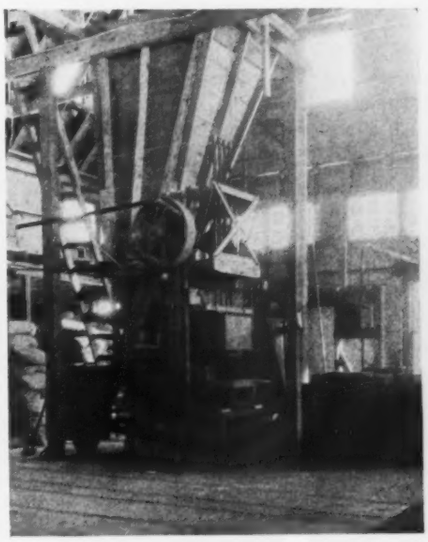


The concrete mixer is placed at the floor level, discharging to a special skip serving the block machines

Sturtevant Engineers, Inc., will start with a staff of 34 experienced engineers, all of whom were formerly with the Sturtevant Mill Co. All records covering 45 years of Sturtevant experience have been acquired by the engineering company.

The officers of the new corporation are: L. H. Sturtevant, president; Wm. T. Doyle, H. A. Tomlinson, vice-presidents, and W. H. Ellis, treasurer. Offices are located at 103 Clayton street, Dorchester, Mass.

Details of the operation of the new plan have been incorporated in a book, "Co-operative Engineering," and this will be sent without charge to interested parties.



One of the automatic strippers at the Lexington Concrete Products Co., subsidiary of the Central Rock Co.

Construction of Storage Silos in Modern Stone Crushing Plants

By Dr. E. Lee Heidenreich
Consulting Engineer, Kansas City, Mo.

MOST of the papers and dissertations published previously on lateral pressure of materials against retaining walls were referred to in the paper by Jacob Feld, Jun. Am. Soc. C. E. with discussions, delivered before the Am. Soc. C. E., March 7, 1923, and contained in Transactions, Paper No. 1529. An able discussion of lateral and vertical pressure in reinforced concrete bins for the storage of cement was contributed by H. A. Ward, engineer, Turner Construction Co., Buffalo, at the annual convention of the American Concrete Institute, 1925, and is printed in the proceedings—but to my knowledge, no proper theory, or no distinction, has so far been brought forward as to the action of crushed stone of *different size and weight*—upon the conditions determining the strength—computations of circular or square concrete storage bins for such materials.

Classification of Materials

C. C. Williams, member, American Society of Civil Engineers, in his "Design of Masonry Structures," 1922, classified the non-solid and non-liquid materials as follows:

1. *Granular materials,* in which pressure increases with the depth; nowhere can there be an upward component, and at all points the ratio of vertical to horizontal pressure is a function of the angle of internal friction.

2. *Fragmentary materials,* in which, after a certain depth, there is no lateral pressure, for the material acts as a solid after the rough particles are held together by intercogging under load.

3. *Plastic materials,* in which the ratio of vertical to horizontal pressure is a constant at all depths.

4. *Viscous materials,* almost liquid.

Crushed rock would come under item 2, "Fragmentary Materials," but the action of the materials largely depends upon its size and weight. We will consider a large and modern stone crushing plant where the material is classified as 2½ in., 1½ in., 1¼ in., 1 in., ¾ in., ⅝ in., ⅜ in. and screenings. Each size stone has a storage bin 50 ft. inside diameter and 80 ft. high, and where it had been proposed to use the same formulas for lateral and vertical pressure in all tanks. The principal theories for earth pressure against retaining walls have been based upon the angles of natural repose, internal resistance giving the coefficient of friction and internal friction, governing the friction of the material against the confining walls. The determination of the lateral pressure hitherto has depended upon the angle of repose, ϕ, and the angle of friction against the bin wall, ϕ', and these two angles in the case of different sizes of crushed stone have been assumed to be the same. The ratio "K" between the lateral and vertical pressure at the wall is more or less a function of the angle of repose, ϕ, and the tangent of the angle, ϕ', and this ratio may be approximately determined by the formula:

$$k=\frac{1-\sin\phi}{1+\sin\phi}$$

This value was determined by Gilbert and Barth in 1906 to be for cement equal to 0.4, which is considerably higher than for even fine screenings. The formula is correct for a retaining wall and for silos of great diameters, such as 50 ft. or more.

Lateral Pressure Calculation

The lateral pressure in circular tanks is usually determined by the Janssen formula:

$$L=\frac{WD}{4\mu'}\left(1-e^{-4\mu' k\frac{H}{D}}\right)$$ in which:

L=Lateral pressure lbs. sq. in.
D=Diameter of bin in ft.
k=Ratio lateral pressure to vertical.
μ'=Tangent angle of friction on concrete wall.
w=Weight of material lb. per cu. ft.
H=Depth of material to section considered in ft.
V=Vertical pressure to section considered in lb. per sq. ft.
e=2.71828.

In the prepared design of these silos the following data have been used:

w=100.
μ'=.767.=tang. ϕ'=tang. 37 deg. 30 min. for all sizes and weights of crushed rock.

Angle of friction on bin wall, 37 deg. 30 min.=ϕ'.

Angle of repose, 32 deg. 40 min.=ϕ.

k=0.300.—which is shown in curve No. 4 in our diagram.

We find that ϕ' is greater than ϕ—hence the assumptions must be wrong.

Using, however,

w=98.5—for 2½ in., 1½ in., 1¼ in. and 1 in. stone.
μ'=0.7=tang. ϕ'=tang. 35 deg. 0 min.
ϕ=39 deg. 0 min.

$$k=\frac{1-\sin 39\text{ deg.}}{1+\sin 39\text{ deg.}}=\frac{.37068}{1.62932}=0.228$$—and curve No. 1 is produced.

And, for

w=95—for ¾ in., ⅝ in. and ⅜ in. stone.
μ'=0.60=tang. ϕ'=tang. 31 deg. 0 min.
ϕ=35 deg. 0 min.

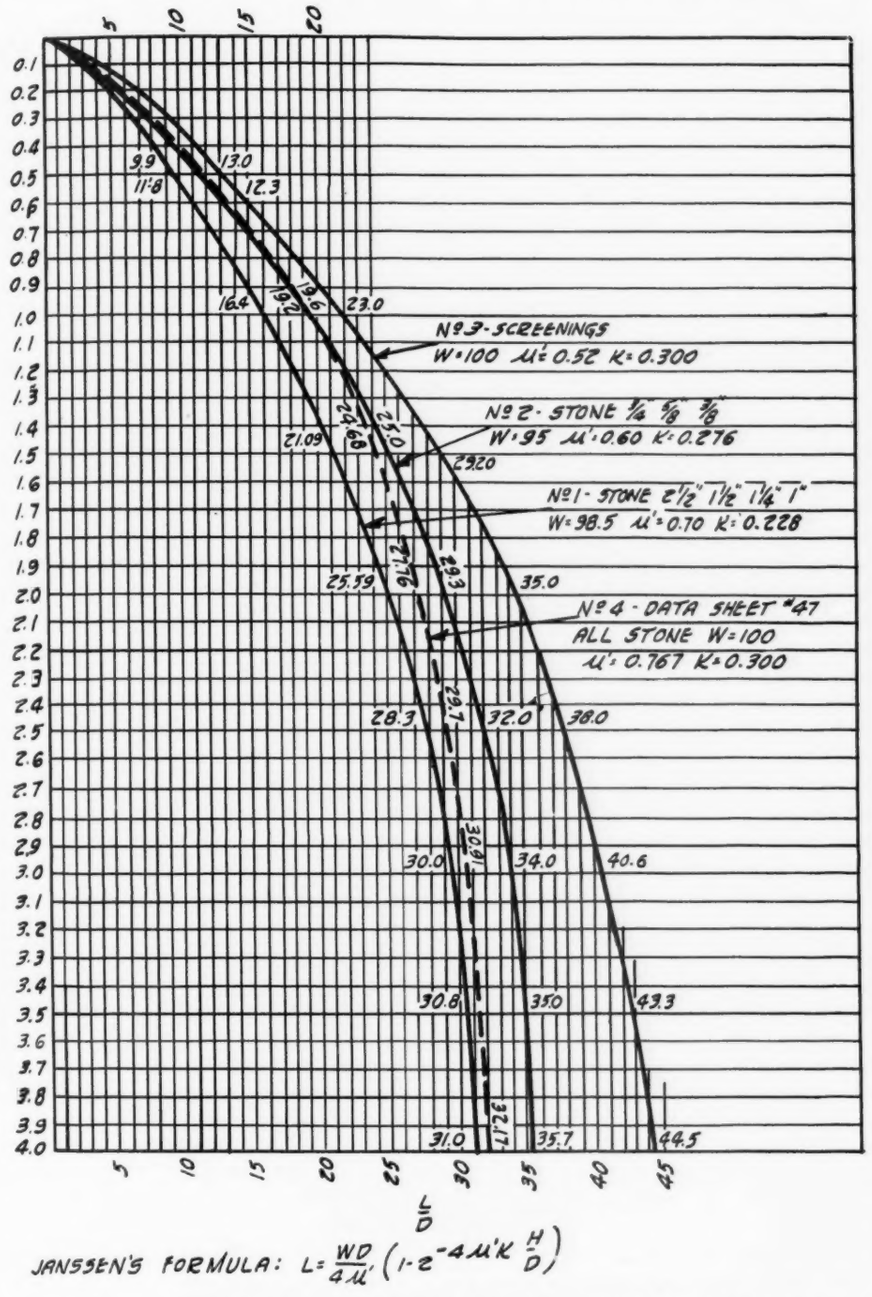
$$k=\frac{1-\sin 35\text{ deg.}}{1+\sin 35\text{ deg.}}=\frac{.42642}{1.57358}=0.276$$—and curve

TABLE No. 1—DIFFERENCE IN STEEL REQUIRED FOR REINFORCING

Curve No. 1 2½-in., 1½-in., 1¼-in., 1-in. stone $T=\frac{L}{D}\frac{50^2}{2}$					Curve No. 2 ¾-in., ⅝-in., ⅜-in. stone $T=\frac{L}{D}\frac{50^2}{2}$			Curve No. 3 Screenings $T=\frac{L}{D}\frac{50^2}{2}$		
H	$\frac{H}{D}$	$\frac{L}{50}$	$1250\frac{L}{D}$	$\frac{T}{18{,}000}$	$\frac{L}{50}$	$1250\frac{L}{D}$	$\frac{T}{18{,}000}$	$\frac{L}{50}$	$1250\frac{L}{D}$	$\frac{T}{18{,}000}$
80	1.6	22.5	28,125	1.56 sq. in.	25.41	31,762	1.75 sq. in.	31.00	38,750	2.14 sq. in.
70	1.4	21.0	26,250	1.455 sq. in.	23.91	28,250	1.62 sq. in.	28.00	35,000	1.84 sq. in.
65	1.3	18.6	23,250	1.29 sq. in.	23.00	28,750	1.59 sq. in.	25.5	31,875	1.76 sq. in.
55	1.1	17.6	22,000	1.24 sq. in.	20.99	26,238	1.45 sq. in.	24.0	30,000	1.66 sq. in.
50	1.0	16.5	20,250	1.20 sq. in.	19.87	24,838	1.38 sq. in.	23.0	28,750	1.59 sq. in.
45	0.9	15.5	19,375	1.07 sq. in.	18.55	23,188	1.29 sq. in.	20.5	25,625	1.42 sq. in.
40	0.8	14.0	17,500	0.97 sq. in.	17.16	21,450	1.19 sq. in.	18.5	23,125	1.28 sq. in.
35	0.7	12.7	16,125	0.895 sq. in.	15.71	19,630	1.08 sq. in.	17.0	21,250	1.17 sq. in.
30	0.6	11.0	13,750	0.762 sq. in.	13.99	17,480	0.97 sq. in.	14.5	18,125	1.05 sq. in.
25	0.5	9.9	12,125	0.672 sq. in.	12.18	15,225	0.845 sq. in.	13.0	16,250	0.9 sq. in.
20	0.4	8.0	10,000	0.555 sq. in.	10.16	12,700	0.705 sq. in.	11.0	13,750	0.765 sq. in.
15	0.3	7.0	8,750	0.485 sq. in.	7.92	9,900	0.55 sq. in.	9.0	11,250	0.625 sq.in.
10	0.2	5.5	6,875	0.381 sq. in.	5.58	7,000	0.39 sq. in.	6.5	8,125	0.45 sq. in.
5	0.1	4.0	5,000	0.277 sq. in.	2.90	3,625	0.200 sq. in.	3.25	4,062	0,226 sq. in.

TABLE No. 2—DESIGNS OF TANKS FOR DIFFERENT SIZED MATERIALS

Curve No. 1 15 ft. by 35 ft. and 15 ft. by 21 ft. $T=\frac{L}{D}.\frac{D^2}{2}=112.5\frac{L}{D}$					Curve No. 2 15 ft. by 21 ft.			Curve No. 3 Screenings		
35	2.33	26.5	2,980	0.165 sq. in.	30.8	3,470	0.193 sq. in.	36.7	4,130	0.228 sq. in.
30	2.0	25.5	2,880	0.160 sq. in.	29.9	3,360	0.187 sq. in.	35.0	3,940	0.218 sq. in.
25	1.67	23.0	2,590	0.144 sq. in.	27.0	3,040	0.169 sq. in.	31.5	3,550	0.198 sq. in.
20	1.33	20.0	2,250	0.125 sq. in.	23.5	2,640	0.147 sq. in.	27.0	3,040	0.169 sq. in.
15	1.00	18.5	2,080	0.116 sq. in.	20.0	2,250	0.125 sq. in.	23.0	2,590	0.144 sq. in.
10	0.67	12.0	1,350	0.075 sq. in.	14.5	1,640	0.087 sq. in.	16.0	1,800	0.100 sq. in.
5	0.33	7.5	850	0.047 sq. in.	8.5	955	0.053 sq. in.	10.0	1,125	0.0625 sq. in.


Nº 3 - SCREENINGS
W=100 μ'=0.52 K=0.300
Nº 2 - STONE ¼" ⅝" ¾"
W=95 μ'=0.60 K=0.276
Nº 1 - STONE 2½" 1½" 1¼" 1"
W=98.5 μ'=0.70 K=0.228
Nº 4 - DATA SHEET #47
ALL STONE W=100
μ'=0.767 K=0.300
L/D

JANSSEN'S FORMULA: $L=\frac{WD}{4\mu'}\left(1-2^{-4\mu' K\frac{H}{D}}\right)$

L=LATERAL PRESSURE LBS. SQ. IN. D=DIA. BIN IN FT. K=RATIO LATERAL PRESSURE TO VERTICAL. μ'=TANG. ANGLE OF FRICT. ON CONC. WALL W=WT. OF MATERIAL LBS. CU. FT. H=DEPTH OF MAT. TO SECT. CONSID. IN FT. V=VERT. PRESS. SECT. CONSID. LBS. SQ. FT.

Diagram for determining lateral pressure in circular tanks (Janssen formula)

No. 2 is produced.

For screenings:

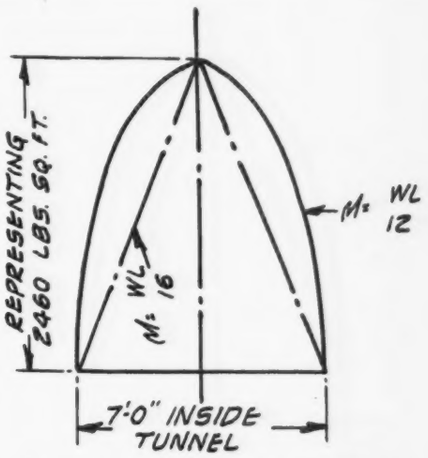
w=100.

μ'=0.52=tang. 27 deg. 30 min.

ϕ=32 deg. 40 min.

$k=\frac{1-\sin 32 \text{ deg. } 40 \text{ min.}}{1+\sin 32 \text{ deg. } 40 \text{ min.}}=\frac{.46025}{1.53975}=0.30$—and curve No. 3 is produced.

Table No. 1 shows the difference in steel required for reinforcing by the two designs. In this table the notations are as before, T=tension stress in pounds per square inch in the reinforcing. Table No. 2 shows the designs of tanks 15 ft. dia. by 35 ft. high and 15 ft. by 21 ft. high, using the different values for "k", derived from using different angles of repose for the different size materials. Table No. 3 shows the design for 20-



Illustrating the method of calculating vertical pressure on screening bin walls

ft. bins 60 ft. high, all bins being designed to hold screenings.

The method of calculating the vertical pressure on the top of the tunnel at the bottom of the bin consists in deducting the vertical pressure on the bin walls from the total weight of the stone contained in the bin and forming this pressure into a paraboloid (or possibly an ellipsoid) instead of a triangle, whereby we get the moment $M=\frac{WL}{12}$ in place of $\frac{WL}{16}$. This is shown at bottom of Table No. 3.

TABLE NO. 3. DESIGN DATA FOR SCREENING BINS
Shipping Bins 20 ft. dia. by 60 ft. All Bins to Hold Screenings

H	$\frac{H}{D}$	$\frac{L}{D}$	$T=\frac{L}{D}\frac{20^2}{2}=200\frac{L}{D}$	$A_s=\frac{T}{18000}$	
60	3.0	40.6	8120	0.452	½ in. ϕ 5 in. o.c.
55	2.75	39.3	7860	0.437	½ in. ϕ 5 in. o.c.
50	2.5	38.0	7600	0.422	½ in. ϕ 5½ in. o.c.
45	2.25	36.3	7260	0.403	½ in. ϕ 5½ in. o.c.
40	2.0	35.0	7000	0.388	½ in. ϕ 6 in. o.c.
35	1.75	31.8	6360	0.353	½ in. ϕ 6 in. o.c.
30	1.5	29.2	5840	0.324	½ in. ϕ 7 in. o.c.
25	1.25	26.1	5220	0.290	½ in. ϕ 8 in. o.c.
20	1.0	23.0	4600	0.255	½ in. ϕ 8½ in. o.c.
15	0.75	17.9	3580	0.198	½ in. ϕ 12 in. o.c.
10	0.5	13.0	2600	0.145	½ in. ϕ 15 in. o.c.

TABLE NO. 4. RELATION BETWEEN ANGLES OF REPOSE AND FRICTION FOR EARTH AND GRAVEL BASED ON DIFFERET MOISTURE CONTENTS

Percentage of moisture	Wt. in lb. per cu.ft.	Angle of natural slope	Angle of internal resistance	Angle of internal friction
0.0	103	30 deg. 15 min.	28 deg. 20 min.	28 deg. 20 min.
3.05	93	35 deg. 00 min.	31 deg. 20 min.	29 deg. 30 min.
3.24	94	38 deg. 20 min.	31 deg. 50 min.	28 deg. 30 min.
3.49	96	32 deg. 45 min.	29 deg. 40 min.	27 deg. 30 min.
3.50	97	34 deg. 00 min.	31 deg. 00 min.	29 deg. 00 min.
3.55	97	36 deg. 30 min.	30 deg. 20 min.	27 deg. 30 min.
3.65	97	34 deg. 50 min.	30 deg. 30 min.	27 deg. 55 min.
3.73	97	35 deg. 00 min.	31 deg. 00 min.	29 deg. 15 min.
3.73	97	36 deg. 00 min.	31 deg. 50 min.	29 deg. 40 min.
4.2	94	38 deg. 00 min.	34 deg. 30 min.	32 deg. 00 min.
4.9	93	35 deg. 30 min.	33 deg. 50 min.	31 deg. 50 min.
8.9	95	39 deg. 30 min.	38 deg. 00 min.	35 deg. 30 min.
9.4	100	40 deg. 00 min.	37 deg. 00 min.	34 deg. 00 min.

The coefficient μ', being the tangent of ϕ', is the coefficient of friction of the material on the bin walls, has been determined as following very closely but a little behind the angle of repose ϕ.

Table No. 4 shows the approximate relation between the angles ϕ and ϕ' for earth or gravel as quoted by Jacob Feld on page 1585 of his paper, No. 1529, based upon the weight of material for different percentages of moisture, the angles of repose and of friction showing that the latter closely follows after the angle of repose, according to my assumptions above.

I have assumed that similar relation exists between fragmentary materials. If required, I could give further details as to the theories and experiments produced by prominent engineers, both in the United States and Europe, but space forbids it in this article. The specifications for concrete in these exposed bins will be added in a later article. I should be glad to have results from experiments on the different sizes of crushed stone and screenings as to the values of the angles ϕ, ϕ' and the ratio "k," as ascertained by the readers and based upon further tests and experiments.

Tunnel at end of silos:

For screenings my curve No. 3 at 10 ft. from bottom, or $\frac{H}{D}=2.5$.

We have $\frac{L}{D}=38.0$, $L=38\times20=760$ lb. per sq. ft.

$V=\frac{760}{0.3}=2540$, weight of screenings at 50 ft.$=50\times100=5000$ lb. per sq. ft. on wall.

5000—2540=2460 lb. per sq. ft. on bottom at 50 ft. depth.

$M=2460\times\frac{7^2}{12}=120{,}540$ in lb. considering the paraboloid

$$d=\sqrt{\frac{M}{2f_c}}=\sqrt{\frac{120540}{1500}}=\frac{2\text{ in.}}{11\text{ in.}}=9\text{ in.}$$

$18{,}000\times0.875=15800$.

$$A_s=\frac{M}{f_s x j\ xd}=\frac{120540}{15800\times10}=0.77\text{ sq. in.}$$

Beam Strength of Road Slabs

IN A recent isue of the *Crushed Stone Journal*, A. T. Goldbeck writes on "Why Concrete for Highways Should Be Tested for Its Beam Strength." The greater part of the article, which takes six and a half pages of the *Journal*, is a detailed explanation of the elementary facts of beam strength and a discussion of the stresses that are applied to concrete road slabs and how they arise. Diagrams show how the road slab acts as a beam when the wheel load is applied.

It is shown that the compressive strength of concrete is always much more than sufficient to resist any vertical compressive stress due to traffic. Vertical and horizontal compressor stresses that arise from expansion and contraction have been known to "blow up" a road, but they can be taken care of with a proper design, allowing for expansion. The rule is laid down that if concrete has high beam strength it will have sufficiently high compressive strength, "but it does not follow that concrete having high strength in compression will always have high enough strength in flexure or cross bending." And the fact that there is little or no relationship between compressive strength and cross-bending strength is shown by tests made in the laboratory of the National Crushed Stone Association and tests by the Bureau of Public Roads. The differences shown in these tests are differences due to the coarse aggregates which were used in making the concrete that were tested.

For the reasons given in the paper concrete road slabs are now quite generally designed to meet cross-bending stresses, the thickness being found by taking the square root of three times the wheel load divided by the modulus of rupture. One-half the modulus of rupture is generally used as a divisor to provide a factor of safety. Mr. Goldbeck suggests that it might be safer to use less than one-half the modulus of rupture (which would result in a thicker slab) to allow for fatigue. It has been shown by the Purdue University tests, and other tests, that a concrete beam subjected to repeated bending stresses, which are only half that required to break the beam at once, weaken the beam. Such stresses are given concrete road slabs in service. He also points out that many concrete road slabs are designed without any factor of safety, whatever.

A typical illustration is given by supposing that two of the aggregates used in the tests mentioned were used in a road slab. With one aggregate the cross-bending strength would be so low that the concrete would be rapidly weakened by fatigue, while the other would suffer little or no fatigue. One slab would break up under traffic while the other would not.

To answer the criticism of engineers who raise the point of the possibility of designing for beam strength, the paper suggests the following procedure as one that is entirely feasible and "one that will insure the production of concrete roads having uniform beam strength":

1. First it is necessary to determine the shape of a modulus of rupture-water cement ratio curve or curves typical of the materials proposed for use.

2. Determine the seven-day beam strengths of concrete made of the particular materials under consideration, using an assumed water-ratio, as close as possible to that which will finally be used.

3. Draw a curve through the seven-day strength result parallel with the established modulus of rupture-water cement ratio curve and thus to determine the actual water-cement ratio necessary to give the desired strength with the particular materials which will be used on the job.

4. Make a trial batch of concrete using the necessary water-cement ratio from which the necessary proportions are determined.

5. These proportions will serve to set the mix in the field, which may be altered as the job proceeds and as the necessity for this is indicated by the field beam specimens, and by the workability of the concrete.

It will be noted that by the above procedure the data from which the road slab is designed are all obtained by testing the actual materials going into the slab.

Canadian Sand and Gravel Production in 1928

A NEW high mark was established in the production of sand and gravel in Canada during 1928 when 28,102,917 tons valued at $5,809,431 were produced, according to finally revised statistics just issued by the mining, metallurgical and chemical branch of the Dominion Bureau of Statistics. The 1928 production was 22.4% greater in quantity but 4.0% lower in value than the 1927 total of 22,952,819 tons worth $6,056,601.

Imports of sand and gravel into Canada in 1928 amounted to 588,211 tons appraised at $275,322, consisting of 585,885 tons from the United States, 2176 tons from Belgium and minor quantities from the United Kingdom. Silica sand imported for glass and carborundum manufacture and for use in steel foundries totaled 154,384 tons at $332,338, including 121,578 tons from the United States, 27,783 tons from Belgium, 5023 tons from the Netherlands and a small shipment from the United Kingdom. Sand and gravel exports were recorded at 797,111 tons appraised at $232,422.

Employes totaled 7831 and their earnings were $2,468,468. Excluding statistics regarding the sand and gravel operations of railroad companies, capital employed in the cost of pits, equipment, stock on hand, cash and collectible accounts, by the 493 other operators in this country, amounted to $7,783,135. Fuel and electricity used during 1928 cost $193,391. Primary power employed was 106 units rated at 4751 hp.

Blast Furnace Slag for Sewage Trickling Filters

THE National Slag Association, Cleveland, Ohio, is distributing a reprint of C. C. Hommon's discussion of the 1929 "Progress Report" of the Filtering Materials Committee, Sanitary Division, American Society of Civil Engineers. This paper was presented at the society's January, 1930, meeting and as now published contains the field and laboratory data on which Mr. Hommon's discussion was based.

Cement Admixtures—A Comment

An Open Discussion of Duff Abrams' Recent Report

EDITOR, ROCK PRODUCTS:

We wish to congratulate you on your editorial comment relative to cement admixtures. This is one of the best statements of the admixture situation that we have yet seen and we think it is quite timely in view of the effort put forward by apparently disinterested parties to condemn broadly and blindly all admixtures. It seems to us just as logical to say that rock and sand in concrete are injurious adulterants as to say blindly that commercial admixtures "must be classed as injurious adulterants."

Admixture Problem Confusing

According to Duff Abrams' opinion, the use of lime for many years past must have been ill advised and has been an injurious adulterant of cement. If portland cement does not under special conditions require an admixture to improve its plasticity, then it is to be wondered at that in all masonry work hydrated lime or some other admixture has always been demanded by the actual user of the cement. If more cement is the answer to the admixture question, then it may be asked why more cement does not solve the problem of the plasticity of masonry cement and why portland cement should not fulfill all the requirements for masonry cement as to plasticity and workability.

As a matter of fact, it seems that each new generation must thresh out the admixture problem. Recently we have been presented with a number of extensive reports, the purpose of which has been to prove that admixtures in general are injurious. In one case at least the premises have been so drawn that, no matter what the physical results may have been, the conclusions would be the same.

Unfortunately, much of the misunderstanding on this important question has been caused by the lack of a satisfactory laboratory method of determining workability of concrete. The development of admixtures has been largely due to the fact that their marked value has been apparent from practical work rather than from arbitrary tests.

Abrams' Tests Ignore Water-Cement Ratio

The conclusions drawn by Duff Abrams on his own tests completely ignore the water-cement ratio and, if these tests are analyzed on the basis of the water-cement ratio, a different conclusion is inevitably reached. On the assumption that the correct amount of admixture was used in each case and that it was used in a proper manner, a resumé may be made of certain of the Duff Abrams tests as follows:

COMPARISON OF TESTS WITH AND WITHOUT BENTONITE
(Abrams Tests)

Reference Number	41	67
Bentonite	None	2 lb. (3%)
Cement, lb.	68	66
Mix	1:1.7:3.0	1:1.7:3.0
Water-cement ratio	0.93	0.95
Slump	6 in.	2¼ in.
Compressive strength, 28-day, lb./in.²	4210	4600

The above tests show an increase in compressive strength of about 10% when 2 lb. of bentonite is used replacing the cement and with a slight increase in water, with the concrete otherwise the same.

COMPARISON OF TESTS WITH AND WITHOUT BENTONITE
(Abrams Tests)

Reference Number	5	8	18	24
Lb. cement	*47.5	*47.5	†47.5	†47.5
Admixture (Bentonite)	None	5%	0	5%
Water-cement ratio	1.01	1.01	0.96	0.93
Slump, inches	7½	2¼	8	2¼
Comp. strength, lb./in.²				
1 day	470	530	1250	1600
2 days	980	1120	2410	2600
3 days	1300	1520	2660	2850
7 days	2020	2120	3470	3610
28 days	3100	3230	3780	4050
3 months	3910	3740	4420	4480

*Standard. †High early strength.

Bentonite Admixture Beneficial

From the above data taken from Abrams' paper in the Proceedings of the American Society for Testing Materials, Vol. 29, Part II, 1929, arranged on the basis of the same water-cement ratio and picking out a type of admixture that in Abrams' conclusion is stated to be most injurious, it will be seen that in practically all instances the action of bentonite increased the compressive strength and in one instance, with the cement replaced by the bentonite and with a higher water-cement ratio, there was an increase in strength of nearly 10%.

As you have stated in your editorial comment, while the character of the cement has much to do with the effect of the admixture, it may be generally stated that the use of bentonite in practically all cases where there is constancy in the amount of water increases the strength.

This is based on many hundreds of tests made by various laboratories in the United States and Canada. Apparently the reason for the adverse opinion of some research workers on the effect of admixtures has been due to their persistence in using an excessive amount of water or considerably more water when the admixture is used than when the admixture is not used. The justification for using the greater amount of water has been based on the lower slump test as a general rule with the use of admixture. The additional water has been added to give the same slump test.

Slump Test Not a Measure of Workability

It should be apparent that the slump test is not a measure of the workability of concrete. One of the most important elements relative to the handling of concrete is the inter-particle friction; that is, the friction between the pieces of aggregate in the mix. Anything that will reduce this inter-particle friction will improve the workability of the concrete. It is perfectly obvious that the slump test is not a measure of inter-particle friction. A slump test on dry aggregates such as standard sand, river sand, bank sand, crushed rock and the like is between 6 and 9 in. Such a slump test with dry materials certainly does not indicate that they are easily workable in that state. If water is substituted for air as the carrying medium for the aggregate, there is not much improvement; if a cement paste is substituted for air or the water, there is of course some improvement, but the improvement is not sufficient if the rock particles are allowed to be in contact with each other. One of the physical purposes of an admixture, therefore, is to prevent the particles of aggregate from actually rubbing against each other, just as a film of lubricating oil is used to prevent a rotating shaft from coming into too close contact with its bearing. Every particle of aggregate should be coated with a lubricating film incorporating the cement.

If the internal friction of a mass of concrete is measured by the amount of work required to pull a paddle or shovel through the concrete, then it is immediately apparent that the slump test is not proportional to the work necessary. That the slump test and the flow test are not proper measures of workability or plasticity is rather generally conceded by impartial engineers.

The slump test of course is of use on each particular job as a means of maintaining uniform conditions with the same materials. There are cases where a 7-in. slump might be desirable or necessary and other cases where a 1½-in. slump is perfectly satisfactory. In some instances, certain harsh materials cannot be properly placed without the use of suitable admixtures, regardless of the slump. In other cases, where concrete may be handled satisfactorily without admixture with a 7- or 8-in. slump, it may be handled more satisfactorily with a 3-in. slump with a proper admixture, properly used.

Effects of Puzzolans

It has been somewhat surprising that many of the present-day experimenters on admixture have overlooked the great mass of literature relative to the effect of puzzolanic

materials on portland cements. Experiments along this line have been made very extensively, particularly abroad, but to a considerable extent in this country as well, ever since portland cement has been available.

One of the earliest, if not the earliest, articles relating to the use of admixtures in connection with American-made portland cements was presented before the American Society of Civil Engineers by Andreas Lundteigen, April 7, 1897. It is well worth while to quote the opening statement made by Mr. Lundteigen in this paper:

"A number of years ago the Society of German Portland Cement Manufacturers published an article claiming that good portland cement could not be improved by admixtures. It seems likely that the purpose of that article must have been to counteract any endeavor by dishonest men to add poor admixtures, and thus lower the reputation of German portland cement, which then had begun to invade the markets of the world. It is also possible that experiments with many cements made before that time would not show the advantage of fine siliceous admixtures as well as the present high-limed and high-testing cements. Besides, it may also be that both good and valueless admixtures were treated under one head and therefore condemned."

Chemical Properties of Admixtures Must be Considered

There has been a tendency, of course, for engineers particularly to treat the use of admixtures from a strictly physical standpoint, while as a matter of fact other elements enter into the matter than questions of physical relation. Mr. Lundteigen pointed out in his paper 32 years ago that, under the hydration and hardening of cement mortar, "a part of the lime is continuously set free or separated from its molecular combination with the silica, alumina or iron; or, in other words, these last substances are able to combine with more lime and magnesia in a dehydrated state in the kilns than in a hydrated state in the mortar. Dr. Michaelis finds that about 33% of the hydrate of lime in the average portland cement is set free and will seek other material to combine with. If reached by the air it will take up carbonic acid and form a carbonate, which does not injure the concrete; in pure water it will be washed away in the water, and the concrete will be left more porous and weaker; in seawater, or water containing mineral salts, these salts will combine with the calcium hydrate and form voluminous double salts, which will swell and destroy the concrete. Gerhart Herfeldt discusses this same subject and shows, like Dr. Michaelis, how portland cement can be improved by admixture of trass."

In short, the article by Mr. Lundteigen shows that in almost all types of admixtures with sand the use of some type of volcanic silica, trass or the like is definitely beneficial to cement and may even be used to replace cement. As an illustration of this effect, the following table of various tests made by Mr. Lundteigen is extremely interesting and instructive.

There are several important things to be noted about these tests: first, that the use of the admixture as a replacement at first reduces the strength, later greatly increasing it and, finally, exceeding in most cases the strength of the cement itself. These tests are excellent illustrations of the practical value of the reaction of the available lime with volcanic silica. The volcanic silica used by Mr. Lundteigen in these tests came from the volcanic ash such as is found in great quantities in Nebraska, western South Dakota, Wyoming, Colorado and other places. The chemical composition is very similar to that of Santorin earth from Greece and trass from Germany, as well as the volcanic bentonite materials in western South Dakota, Wyoming, California and Nevada. Such materials of volcanic origin react to take up the excess of lime developing during the hardening and setting of cement.

In view of the importance of this subject it is to be hoped that chemists will properly analyze the considerable amount of very valuable data on concrete that is being accumulated.

One of the most important things is the development of a test that will truly set out the workability value of concrete. The slump test should be abandoned as such a measure except under certain fixed and uniform conditions.

Kansas City Testing Laboratory
DR. ROY CROSS.

Kansas City, Mo.
December 27, 1929.

Admixtures in Concrete

THE RECENTLY PUBLISHED *Proceedings* of the American Society for Testing Materials (Vol. XXIX) gives the discussion of Prof. Abrams' paper on the use of admixtures. These were not included in the abstract of the paper published in ROCK PRODUCTS, December 7, 1929.

Admixtures Beneficial to Leaner Mixes

Without exception, those who discussed the paper pointed out that the tests on concrete with admixtures were made on such a rich mix (1:1.7:3) as would not be used in any work except perhaps some highway concrete. The good effect of admixtures is not so noticeable with rich as with lean mixes, as has been shown by many investigators, including Prof. Abrams himself in a former paper. Concerning this Prof. Slater of Lehigh University says in his discussion: "It requires more careful reading than is generally given to such a paper to discover the omission of the leaner mixes, and requires considerable familiarity with the entire field to discover the effect of such an omission on the general applicability of the conclusions."

In discussing the omission of lean mixes, Prof. Slater quotes Prof. Abrams' own work on the effect of hydrated lime and other admixtures in concrete (A. S. T. M. Proceedings, Vol. XX), in which it is shown that with the leaner mixtures the use of admixtures gave either higher strengths for a given flow (consistency) or higher flows for the same strength, and he concludes that this would have been the case if Prof. Abrams had extended the present series of tests to cover the mixtures ordinarily used.

Prof. Slater also criticizes the paper for the assumption that consistency as shown by the flow table is a sufficient measure of workability. Such an assumption ignores the work of Pearson and Hitchcock, and Smith and Conahey, who have designed and used apparatus to measure workability as *distinct* from flow. He speaks of this as a "reversion to an inferior (relatively) criterion for workability, a regrettable setback to progress toward a solution of the workability problem."

The former paper of Prof. Abrams discusses admixtures as added to the cement, the present paper discusses them as substitutes for part of the cement. Prof. Slater says that either method is permissible, but since the need for an admixture is partially brought about by a lack of fine material, it seems logical to make an addition of fine material rather than to substitute it for some of the cement. He speaks of Pearson and Hitchcock's conclusions that 12% of hydrated lime *added* to the cement requirement effected the same improvement in workability that was given by 25% additional cement. This was later confirmed by Smith and Conahey.

W. A. Bruce, of the American Tripoli Co.,

EXTRACTS FROM "NOTES ON PORTLAND CEMENT CONCRETE"*

	Tensile strength, lb./in.²						
	7 da.	28 da.	6 mo.	1 yr.	2 yr.	3 yr.	4 yr.
1 part cement, 3 parts sand, 12% water	77	136	264	298	.....	.....	.....
1 part cement, 1 part volcanic silica, 3 parts sand 14% water	33	100	341	470	582	628	.....
1 part cement, 1 part volcanic silica, 5 parts sand, 12.8% water	40	125	314	374	.....	470	.....
1 part cement, 1 part volcanic silica	95	154	373	546	676	.....	715
1 part cement, 2 parts volcanic silica	42	84	262	474	493	.....	574
2 parts cement, 6 parts sand	129	183	293	366	265	.....	265
1 part cement, 1 part volcanic silica, 6 parts sand	27	92	213	422	473	509	499
1 part cement, 0.5 part lime (partly slaked), 4 parts sand	154	88	Disintegrated		.....	.....	.....
1 part cement, 0.5 part lime (partly slaked), 1 part volcanic silica, 8 parts sand	36	64	168	.....	193	.....	.....
1 part cement, 0.2 part lime (partly slaked), 1 part volcanic silica, 6 parts sand	41	107	492	.....	548	.....	.....
Neat cement	464	601	.....	882	906	.....	978

*Andreas Lundteigen, April 7, 1897, Transactions American Society of Civil Engineers, No. 807.

in addition to noting the omission of lean mixtures, notes that in testing tripoli more of it was used as an admixture than is recommended by the manufacturers. If 3 to 7% (as recommended) had been used instead of 10%, he thinks the results would have been considerably more favorable to "Tripolite."

An important point noted by Mr. Bruce is that admixtures have other functions than promoting strength and workability, the lessening of volume change, the prevention of leakage of water and cement cracks in the forms, and into the ground where forms are not used, better durability and curing.

In his view, concretes containing admixtures are actually richer than concretes without admixtures, if the admixture is added to the cement instead of being substituted for a part of it. He holds that the strength (other things being equal) is fixed by the ratio of cement to aggregate, and this ratio is higher where admixtures are used, as there is more cementitious matter and fines present per unit volume.

Tests with Diatomaceous Earth

G. A. Smith, research engineer of the Johns-Manville Corp., which makes "Celite," a diatomaceous earth, has made especial studies of the workability of concrete, using the penetration apparatus first used by Pearson and Hitchcock. He describes some of the results he obtained in his discussion of Prof. Adams' paper. His experiments were made on mixes richer and leaner than the 1:2:4 base which he took as 100%, and they showed that for the same materials workability varied directly with the cement content (where no admixture was used). Experiments with sand and cement showed that, other things being equal, workability varied inversely as the fineness modulus of the sand. Graphs of these relationships are straight lines. The general conclusion he draws from these and other experiments is that: "Although concrete mixtures may have the same consistency or flow, yet they also have other properties which are influenced by the proportions and the materials used and which are not indicated or measured by the slump test or the flow test. Results obtained with the penetration apparatus indicate changes in the properties of concrete which are parallel with recognized changes in workability due to changes in the mix. Although the flow test or slump test may be used to give indices of workability for different mixes taken separately as the water is varied, the indices are not comparable between mixes."

Effective in Promoting Workability

Tests with "Celite" on mixes richer and poorer than the basic 1:2:4 mix showed that "Celite" was about ten times as effective as cement in promoting workability. Practically the same added workability was given by adding 3.2% of "Celite" as was given by adding 33.3% cement.

The remainder of the paper is largely an analysis of some of Prof. Abrams' figures, too long and involved to be abstracted. One example which shows the importance of small matters in such testing work is the acceptance in the paper of a 177 flow for a 180 flow. The difference may appear trivial, but Mr. Smith shows that it accounts for an actual variation in water-cement ratio from 0.80 to 0.846, enough to seriously vary the strength of the concrete.

A table which gives some of Prof. Abrams' results after this correction for water-cement ratio had been made shows a considerable improvement in the position of concrete containing "Celite" compared with plain concrete.

The Economy of Admixtures

As to the economy of using admixture, Mr. Smith holds that as no one disputes that greater workability can be secured by the use of more cement, the only question is whether cement is the most economical material to use for the purpose. On the basis of $12 per ton for cement and $40 per ton for "Celite," he holds that "Celite" is the more economical material, as the tests given have shown it to be about ten times as effective in promoting workability.

C. P. Derleth, of the Colloy Products Co., says that the flow table used by Prof. Abrams does not reliably measure workability, as it does not take into account the effects of gelatinization and the elimination of segregation. Slump and flow table tests are related and measure consistency, but neither is a measure of workability. He also calls attention to the effect of testing only rich mixes, made with high-early-strength portland cement rich in fines. The effect of admixtures, he says, would be more noticeably beneficent with the more coarsely ground standard portland cement.

Comparison Methods Not Quite Fair

For fair comparison the strengths of admixture concretes tested, he thinks, should be increased by the percentage of cement for which admixtures were substituted. When this is done, admixture concretes show higher strengths than the plain concretes, in spite of the excess water used and the adverse conditions of the tests.

Additional water was used to obtain the same *flow,* although it is generally recognized that the same workability may be obtained with a lesser flow by the use of admixtures. Admixtures also offset the ill effects of segregation in the water mixes and give a slight increase in yield.

He also quotes Prof. Abrams' previous paper to show that its author found an increase of strength of 0.61% for each addition of 1% of hydrated lime, confirmed later by Conahey's findings. In conclusion, he says that the amount of "Colloy" (colloidal clay) used was more than recommended by the manufacturers, and hence the results should not be given consideration. As portland cement manufacturers are making and selling admixture cements and turning to more finely milled and workable cements, he thinks in this way they acknowledge that standard portland cements are deficient in workability.

Abrams' Answer to Discussions

Prof. Abrams, in replying to the criticism of these discussions, points out that while the flow table is not a perfect measure of workability for all types of concretes, it is recognized as such for the concretes of the type tested, and it is employed in the main research laboratories of this and other countries pending further research.

As to replacing cement, his previous paper referred to in several discussions showed the results to be exactly the same when hydrated lime was used as an admixture and when it replaced part of the cement. Furthermore, cement manufacturers are being urged to use these materials at the mill, which would obviously be using them as replacements of cement.

The matter of rich or lean mixtures, in his opinion, is one of the field in which the concretes are to be used. The mixture tested is one regularly used in highways and has been used in buildings. The tendency of the past few years is to use richer mixtures.

Indiscriminate Uses Should Be Curbed

He calls attention to the fact that the indiscriminate use of admixtures is being prohibited by many engineers. An instance brought to his attention was that of a street pavement which showed distinct surface cracks where an admixture was used. The cracks did not appear in the following day's work, when the use of the admixture was discontinued. The same pavement contained holes about the size of a teacup, which the contractor said came from balls of the admixture which were not broken up in the mixer.

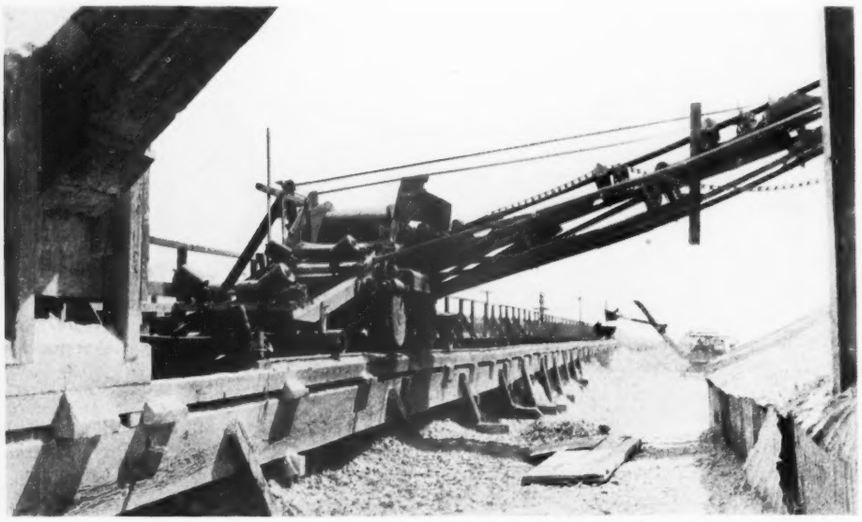
He quotes from the specifications proposed by A. R. Lord, chairman of a specification committee of the American Concrete Institute, which says that nothing shall be added to the essential ingredients of concrete without instructions in writing from the engineer and architect in charge, and then only such materials as have been thoroughly tested by independent engineers. Mr. Lord's comment on this specification is also quoted, in which it is stated that "we have meager reliable information on most admixtures—practically nothing but salesmen's loose talk on others. The instructions on the printed table are sometimes absurd."

Prof. Abrams closes by saying that: "The only conclusion that can be reached from our present knowledge is that portland cement does not require a 'crutch' in the form of an inert powdered admixture in order that we may make a high-grade concrete to meet any requirement."

Hints and Helps for Superintendents

Stockpile Building and Reclaiming

THE Plaster City, Calif., plant of the Pacific Portland Cement Co. has to carry a stock of crude gypsum on hand sufficient to run the plant several months. When building the stockpile a short piece of belt is added to the horizontal belt and threaded through the tripper shown in the illustration. This tripper discharges to a short cross conveyor mounted on a boom-like structure and is fundamentally a part of the tripper.



Boom conveyor builds and reclaims stockpiles

When reclaiming the crushed gypsum in the stockpile the main belt simply passes under the tripper and is loaded by a power shovel that discharges to a suitable belt feeder.

Track Scales Kink

THE Harbison-Walker Refractories Co. operates a silica brick plant at Mt. Union, Penn., using ganister as a source of crude silicious material for this work, securing the stone a few miles from the works.

The rock is delivered to the plant by Porter steam locomotives which pull trains of ten or more cars, each holding three tons of stone. The cars are weighed on a pair of Kron springless truck scales; the stone is loaded on the contract basis, so the weight of each car must be recorded. The cars making up the train are slowly pushed over the scales, it not being necessary to stop to secure an accurate reading on the last car, which in this case would be the one nearest the locomotive, as when it is on the scales a switch is thrown and the heavy steam locomotive goes over a separate switch that does not ride on the scale platform. This is necessary as these scales are not of sufficient capacity to handle the locomotive's weight.

The idea could be used to good advantage in many quarry operations where the rails on the track scales go to make up a section of the main transportation system, as passage of unnecessary loads over any scales, especially if the load is unreasonably high, in the long run impairs scale accuracy.

By-pass switch prevents unnecessary loads passing over track scales

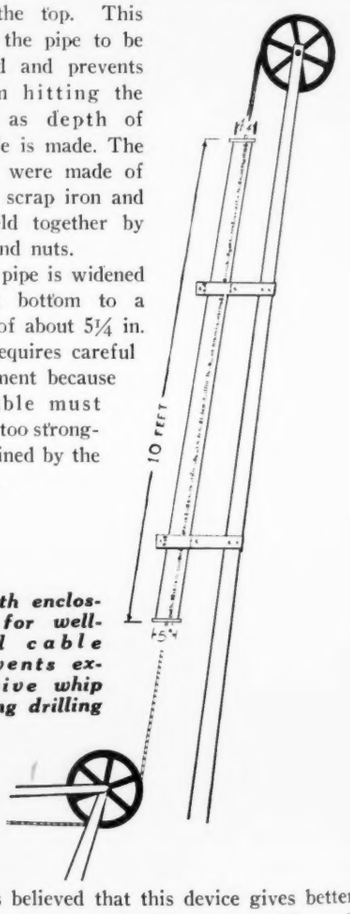
Taking the Whip Out of Well Drilling

By W. C. BARLOW
Plainville, Conn.

A SHEATH of 4-in. pipe, 10 ft. long, has been devised to prevent the excessive whip of the cable in well drilling operations at the No. 4 quarry of the Connecticut Quarries Co., Plainville, Conn.

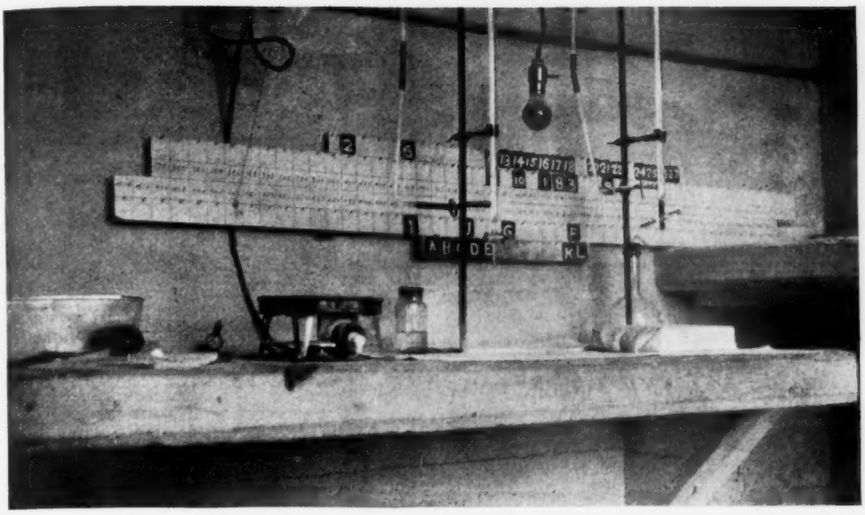
As shown in the accompanying drawing, the pipe is clamped to the derrick, one clamp being close to the bottom and the other 4 ft. from the top. This allows the pipe to be lowered and prevents it from hitting the saddle as depth of the hole is made. The clamps were made of 3½-in. scrap iron and are held together by bolts and nuts.

The pipe is widened at the bottom to a width of about 5¼ in. This requires careful adjustment because the cable must not be too strongly retained by the sheath.



Sheath enclosure for well-drill cable prevents excessive whip during drilling

It is believed that this device gives better tension, increases the life of the cable, and, most important, gives a regularity to the drilling.—*Explosives Engineer.*



Raw cement mixes are calculated accurately and rapidly on this board

Raw Cement Mix Calculator

TO UNDERSTAND the use of this calculator a brief description of the practice at the Santa Cruz Portland Cement Co.'s plant is necessary. There are 40 steel bins for the storage of the limestone before blending. Each bin has a capacity of 80 tons, giving a total of 3200 tons from the crushing rolls. Those bins that are numbered are at one end of the mill and those that are lettered are at the other end, with two Schaffer poidometers located are always set between. The poidometers are always set to handle equal quantities and it is here that the final mix is made.

It is customary to empty four bins simultaneously, two numbered bins to one poidometer and two lettered bins to the other. It is here that the board comes in handy. By selecting two numbered bin tags and two lettered bin tags, which are symmetrical with respect to a vertical axis, it is sure that the mix will be made for which the board is set.

The board in question is simply an automatic adder for CaO percentages representing the various bins. Its principal advantages are to eliminate labor and errors incident to manual calculation and wear and tear on lead pencils.

The board is made of tongue and groove flooring so that it can slip sideways in either direction. The large numbers at the extreme top consist of brass tags with bin numbers thereon, and in this position merely represent *empty* limestone roll product bins. As these bins are filled one at a time, they are sampled and analyzed (alkali-acid titration) for CaO content and tags are then placed on top section of board above the lime percentage which analysis shows them to contain.

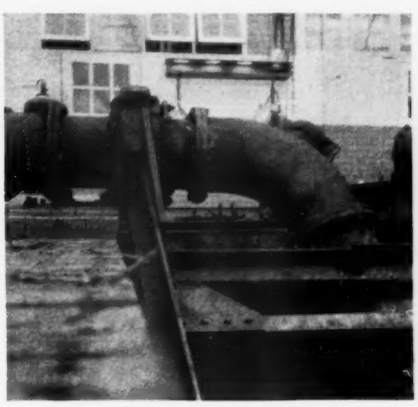
The large letters at the extreme bottom also represent empty limestone roll product bins and are used in the same way, except that when filled they are placed on the bottom section of the board. By shifting the board endways so that the mix CaO percentage desired corresponds on both boards, any mix wanted can be made automatically.

The roll product going to bins is by guess, made to approximate a mix, and the roll operator has sufficient control so that he can make the bin analyses go about like this:

With this control and such a large number of bins to fall back on, there is always from one to six possible combinations on the board. The board as pictured contains only one change, viz., 10-8-G-F, because the picture was taken early in the morning shortly after starting to fill the bins, which operation continues only during the 8-hour day shift.

Adjustable Dredge Sleeves

THE first dredge built by the Ross Island Sand and Gravel Co., near Portland, Ore., had a 50 ft. boom which was recently discarded and one weighing 38 tons and 80 ft. long installed in its place. The suction pipe and Swintek cutter are mounted on the boom. The old flexible coupling between the stationary portion of the suction pipe and that portion mounted on the movable boom was unsatisfactory so a combination expansion joint and sleeve of the type shown was adopted.



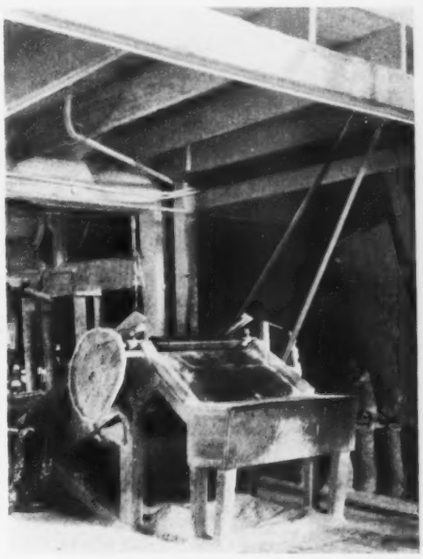
An adjustable dredge sleeve

The elbow joining the stationary end of the movable end is securely bolted to the low end of the ladder pipe and to a movable sleeve at the upper end. Since its adoption no trouble has been experienced from its use.

Sacking Machine Installation

IT IS a common practice to install sacking machines at such elevations that are convenient for the sacking crew to truck directly into the car or to have belt conveyors extending into the car door. This means that the packer must have its foundation plate about 4 ft. above the top of the rails.

At a western plant, however, the sacking machine rests on the ground and discharges to a short inclined belt conveyor which elevates the sacked material to sufficient height as to permit easy truck loading from the steel apron at the conveyor end. The hand trucks can then be wheeled into the car or to the warehouse floor.



Sacker placed so as to facilitate truck loading

The installation has the advantage of saving head room. Further, if a packer has to be installed in an old plant, to have to elevate all the equipment 4 ft. to fit the particular need, is an expense that can be avoided by this method.

Coyote Stemming

IN COYOTE blasting some operators refill the tunnels with the waste material that was removed during the driving of the headings. This is a slow and not altogether satisfactory method. The Pennsylvania Sand Co. at its Keystone operation uses bags of sand for this purpose, and with good results.

Heat Balance of Lime Kilns in Theory and Practice*

By Fr. Lipinski

IN THIS article, the theoretical calculations of the heat balance which exists when burning lime in an ideal state, are given and the findings applied to the actual operation of lime kilns. It is assumed that the reaction $CaCO_3 \longleftrightarrow CaO + CO_2$ is to take place in the lime kiln in the sense of a formation of CaO and CO_2. Definite reaction conditions of pressure and temperature must be maintained in order to make this reaction possible. Therefore a considerable amount of heat must be supplied. In order to evaporate water, 540 w.e.† of heat is required; but in order to dissociate calcium carbonate, 425.2 w.e. of heat is needed. (The author makes a comparison of the temperatures and pressures which prevail in the evaporation of water and in the dissociation of calcium carbonate; he finds the behavior of the reactions quite analogous to the evaporation of water.—Editor's Note.)

Heat Requirements

The temperature at which the partial pressure of the carbonic acid amounts to 760 mm. Hg. is considered to be 897 deg. C. But in order to make the calculations in this article easier, the actual dissociation temperature is assumed to be 900 deg. C. instead of 897 deg. C. The heat required for heating 100 kg. of limestone to 900 deg. C. amounts to $100 \times 0.21 \times 900$, or 18,900 w.e.; 0.21 being the specific heat of limestone ($CaCO_3$). The heat required for effecting the reaction of this limestone amounts to 100×425.2, or 42,520 w.e.; thus 425.2 w.e. is required per kg. of $CaCO_3$. A total of 61,420 w.e. of heat is therefore required, of which only 40,144 w.e. can be considered as actually being used, for after the dissociation has been completed there is available at 900 deg. C. 56% of burned lime and 44% of CO_2, the latent heat of which amounts to 56 (kg. CaO) $\times$ 900 $\times$ 0.21 = 10,584 w.e. and to 44 (kg. CO_2) $\times$ 900 $\times$ 0.27 = 10,692 w.e. respectively.

Considering that coal is to be used in burning the lime, 1 kg. of coal requires 2.7 kg. of oxygen for combustion, which is the oxygen content of 12 kg. of air. The heating of this air to 900 deg. C. requires $900 \times 12 \times 0.258$ or 786 w.e.; the specific heat of the air being 0.258. Thus, for example, of the 8100 w.e. (the calorific value of the coal per kg.) only 5314 w.e. can be used for the dissociation of the limestone.

Assuming that we have an ideal case, in which the total heat of 10,584 w.e. which is contained in the hot burned lime, can be utilized for preheating the combustion air, and the limestone can be preheated to 900 deg. C. by 18,900 w.e. of the heat which is contained in the discharging waste gases, then 29,484 w.e. can be deducted from the total heat requirement of 61,420 w.e. This leaves a theoretical heat volume of 31,936 w.e. to be supplied, for which 6.01 kg. of coal is needed. In order to burn this coal 6.01×12 kg. = 72.1 kg. of combustion air is required, which results in 78.1 kg. of waste gases. As stated above, the heat in the burned lime amounts to 10,584 w.e.; this heat, when used for preheating the combustion air, raises its temperature to 446 deg. C.

Waste Gas Temperatures

The waste gases which leave the burning zone consist essentially of 55.9 kg. nitrogen, 22.2 kg. CO_2 produced in combustion and 44.0 kg. of CO_2 arising from the dissociation of the limestone. Accordingly, the waste gases contain:

$55.9 \times 900 \times 0.258$ (sp. heat of N) = 12,980 w.e.
$22.2 \times 900 \times 0.27$ (sp. heat, CO_2) = 3,765 w.e.*
$44.0 \times 900 \times 0.27$ (sp. heat, CO_2) = 10,692 w.e.

Total ..... 27,437 w.e.

*1632 w.e. is deducted for heating the coal.

For preheating the limestone to the dissociation temperature, 18,900 w.e. is required, so that the waste gases contain therefore 27,437 minus 18,900 w.e., or 8537 w.e., which is not utilized in preheating. This amount of heat corresponds to a waste gas temperature of about 270 deg. C. The heat flow diagram, Fig. 1, shows the above described processes. For 100 kg. of calcium carbonate 48,681 w.e. of heat must be applied, of which 8537 w.e. or 17.5% discharges unused from the plant and 40,144 w.e. or 82.5% is used, theoretically, in the burning process. The heat in circulation amounts to 18,900 w.e., plus 10,584 w.e., or 29,484 w.e.

Assuming the total waste gas heat is utilized, the minimum theoretical fuel consumption is 40,144 divided by 8100 or is 4.95 kg. per 100 kg. $CaCO_3$. This amounts to 8.80 kg. of coal of 8100 w.e. per kg. for 100 kg. of CaO. When the waste gases are not utilized, the fuel requirement is 48,681 w.e. divided by 8100 or 6.01 kg. per 100 kg. $CaCO_3$. This amounts to 10.80 kg. of coal of 8100 w.e. for 100 kg. CaO.

Naturally, the minimum theoretical fuel consumption cannot be obtained in actual operation. There are, however, a number of losses which can be kept down to a minimum although they cannot be eliminated entirely. In investigating the influence each of the various conditions exerts upon the consumption of heat, the following conditions are considered: Presence of impurities in the raw material; presence of fuel ashes; moisture content of the raw stone; higher temperature necessary in actual burning as compared to theory; excess of combustion air. The problems connected with the conductivity of heat and the transfer of heat are considered further along in this article, even though they are also of decisive importance in actual fuel management.

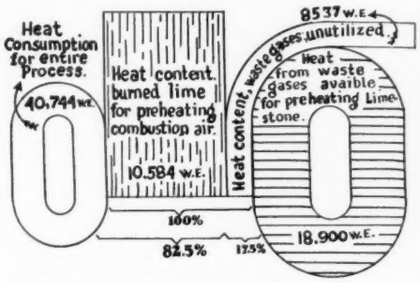


Fig. 1. Heat flow sheet for an ideal shaft kiln lime burning operation

Effects of Impurities in Limestone

The presence of impurities in the raw material means that such material, acting only as a ballast, must also be heated to the high temperature; yet, on the other hand, this heat is utilized in preheating the combustion air. This results in a lower waste gas temperature decrease in the heat losses conditioned by it, and in a higher temperature of the combustion air that enters the burning zone. Assuming that there are 3% impurities (of a silicious nature) in 100 kg. of limestone, the heating of these impurities to 900 deg. C. requires $3.1 \times 0.20 \times 900$ or 558 w.e. The heat in the discharging waste gases decreases by this amount, namely, 8537 minus 558 or 7979 w.e.; this is almost equal to a decrease of 2 deg. C. in temperature. But the heat which is available for preheating the combustion air increases by the same amount, that is, 10,584 plus 558 or 11,142 w.e.; and the required amount of fuel decreases accordingly. Instead of 6.01 kg. of coal, only 5.94 kg. are required; naturally the volume of waste gases is decreased thereby about 0.9 kg., which decreases the heat lost in the waste gases another 270 w.e.

*Tonindustrie-Zeitung (1929) 53, 71, 82, 95.
† 1 W. E. is about 4 B.t.u. To convert W. E. per kg. to B.t.u. per lb., multiply by 1.8.

Incidentally, it may be stated, that in opposition to this definite advantage of the presence of impurities in the raw material, there is the disadvantage that the yield in pure burned lime decreases due to reaction between itself and the impurities, especially when burning takes place at higher temperatures.

Fuel Ashes and Moisture

The presence of fuel ashes acts similarly in mixed fired kilns, in so far as the admixtures do *not* consist of carbonates or sulphides, which use or release heat in the reaction occurring in the kiln. Since the variations in the conditions cannot be determined in general without considering the exact fuel ash analysis—and since there is not a very large amount of it—the presence of the fuel ash may therefore be regarded as not of serious consequence—10% ash in 7.61 kg. coke is only 0.76 kg. ash, which when heated to 900 deg. C. has only 13.7 w.e.

Heat Transfer Problems

Water in the raw stone and also in the fuel has a somewhat different influence. The water evaporates in the preheating zone and discharges with the waste gases. The heat required for its evaporation is drawn from the waste gases; in return the waste gas volume is increased by the volume of evaporated water. The presence of water lowers the waste gas temperature, whereas the waste heat volume remains the same. Therefore only the useful gradient of heat is decreased, and the waste gas heat can be utilized less effectively. For evaporation, 5% of water requires 5×640 or 3200 w.e., and the temperature of the waste gases decreases from 270 deg. C. to 181 deg. C.

In connection with the problems which are conditioned by the heat transfer and by the heat conductibilities of the materials, the necessity for burning at higher temperatures is interesting. There must always be a useful gradient of heat, that is, if a substance must be heated, for example, to 900 deg. C., the heating agent must show temperatures of more than 900 deg. C., for otherwise no transfer of heat to the material to be heated can take place. Assume for the present that a temperature of 1000 deg. C. is required for the heating agent which is the combustion or burning gases; and that furthermore the material to be burned is assigned a temperature of 950 deg. C., this material having at least in part to be heated to higher temperatures in order to assure complete dissociation.

The preheating of the combustion air to a higher temperature results in less heat energy of the fuel being released. Instead of 5314 w.e., 1 kg. of coal of 8100 w.e. can release only $8100 - (1000 \times 12 \times 0.258)$ or 5000 w.e.; on the other hand, due to the higher temperature of the material being burned, more heat is liberated for preheating the combustion air. Instead of 31,936 w.e., only 31,348 w.e. need be supplied to the burning process (dissociation), for the heat content of the hot burned lime is 11,172 w.e. There is required therefore 31,348:5000 or 627 kg. of 8100 w.e. coal, which results in 81.51 kg. of burning gases. The heat contained in them amounts to 31,920 w.e. (1000 deg. C.).

The utilization of the heat contained in these waste gases continues, however, further than in the first example (900 deg. C.), for dissociation takes place not only after reaching the temperature of 1000 deg. C., but limestone is dissociated also in the preheating zone—until the temperature of 900 deg. C. is reached in the waste gases. The heat available for the dissociation in the preheating zone amounts to 3192 w.e., by which amount the heat to be supplied to the burning zone would decrease. On the other hand, the volume of waste gases becomes also less with a smaller requirement in fuel, and with it the heat contained in it. The calculations show that actually the fuel to be supplied is 0.28 kg. less, whereas the waste gases leaving the dissociation zone have a heat content of 31,024 w.e. (In the interest of simplifying calculations it is assumed that the preheating of the material to be burned takes place ahead of the dissociation zone.) The preheating of the limestone to 950 deg. C. requires $950 \times 0.21 \times 100 = 19{,}950$ w.e. Therefore, 6273 w.e. are not utilized. The temperature of the waste gases is 195 deg. C., giving the peculiar condition that in spite of an increase of temperature in the burning zone less fuel is necessary. These results show the importance of the accurate regulation of the temperature of the burning zone and the advantage of a longer dissociation zone.

Effects of Excess Air

An excess of combustion air is unfavorable, but excess is necessary in practice, in order to attain a complete burning. Assume that 10% excess air is used. Then the usable heating value of 1 kg. of coal of 8100 w.e. decreases from 5314 w.e. to $8100 - (900 \times 13.2 \times 0.258) = 5035$ w.e. Then the requirement in fuel is 31,936:5035 = 6.34 kg.; accordingly, the volume of waste gases increases and also the heat contained in them, the volume of heat to be utilized for preheating remaining unchanged. The quantity of waste gases is 126.4 kg. (82.4 kg. combustion gas plus 44 kg. CO_2 from the calcium carbonate). The heat value of the waste gases is 28,357 w.e., of which 9457 are not useful. Temperature of the waste gases is 283 deg. C. The fuel consumption in burning with 10% excess air, figured per 100 kg. of burned lime, is 13.12 kg. of 7000 w.e. coke.

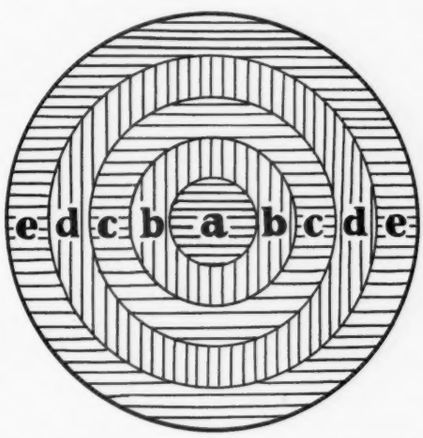


Fig. 2. Section through a sphere of limestone, regular in shape and divided into zones for the purpose of theoretical heat calculations

The above figure comes quite close to the practical (actual) fuel consumption in modern lime kilns (shaft kilns with mixed firing and automatic discharge). The difference is partly due to the fact that the conditions used as a basis in the above calculations (cooling of the burned lime to 0 deg. C., etc.) cannot, of course, be attained in operation.

In the foregoing, the conditions under which the dissociation of $CaCO_3$ into CaO and CO_2 takes place in the kiln have been outlined and the individual factors which affect the burning process considered. However, the calculations were always based upon the condition that the supply of the necessary heat occurs without a loss, an impossibility in practice. In order that the heat can enter from one medium into the other, there must be a temperature gradient or difference in temperature, the range of this gradient depending on various conditions, usually determined by the nature of the various media. Earlier investigations have provided specific constants, for example, the resistance constant for air and burning gases against limestone or burned lime is about ⅛; the reciprocal value gives the heat transfer figure of 8. This means that in one hour 8 w.e. pass from one medium into the other per 1 m. surface and at a temperature difference of 1 deg. C. (This figure is also dependent upon the gas velocity.) It is generally assumed that there is a thin layer of gas at absolute rest directly on the surface of the solid body, which offers a great resistance to the heat transmission; this resistance can be overcome only by selecting a correspondingly high temperature gradient.

Heat Transmission in Solid Materials

Respective to the heat transmission in solid substances, other specific constants for the individual substances have also been determined accurately. The accepted heat conduction figures are as follows: Limestone, 2; burned lime, 1.0. These are based upon a temperature difference of 1 deg. C. on a surface of 1 m., depth of 1 m. and 1 hr. time. It is apparent that the greater the surface is, the more heat can be transferred or transmitted in a unit of time, whereby in the later instance the volume of heat to be transmitted is also dependent upon the depth or thickness of the object.

Thus, utilizing all these factors, the conditions in the lime kiln will be considered also differentiating between dissociation, preheating and cooling. For the calculation it is assumed that the limestone is supplied in spheres of 20 cm. diameter. In order to approximate the rock shapes found in actual operation, the surface area of the sphere is doubled for calculating the heat transition. But in order to find from the calculation at the same time how the conditions prevail for smaller spheres, the spheres will be subgrouped into four hollow spheres and a solid sphere; we differentiate therefore five zones of 2 cm. thickness each for this limestone sphere of 20 cm. diameter, as shown in Fig. 2, in which *a* is the solid sphere of 2 cm. radius. The specific gravity of the limestone being 2.4, the following data are obtained (Table I).

Dissociation

The process of dissociation starts when the limestone has reached the temperature of 897 deg. C. Heating of the material is effected in the preheating zone by the gases moving against it, the heat being transferred from the exterior into the material to be burned. This means that the exterior zone *e* attains a temperature of 900 deg. C. to 897 deg. C. sooner than the core *a*. But after the dissociation temperature has been reached dissociation starts at once and heating of the inner portions takes place only after the dissociation of the exterior zone has been completed. These calculations are based on a temperature of 900 deg. C. at the periphery of the sphere and of 800 deg. C. at the core. The dissociation period is figured to be 32 hours.

The heat supplied to the individual zones is then calculated, using weight data from above, the specific heat of the limestone and the reaction heat of 425.2 w.e. per kg.:

Zone		Initial temperature, deg. C.
a	35 w.e.	810
b	250 w.e.	830
c	640 w.e.	850
d	1240 w.e.	870
e	2000 w.e.	890
Total (sphere)	4165 w.e.	

The dissociation period of 32 hours is distributed through the different zones as follows: $a = 2$ hr., $b = 4$ hr., $c = 6$ hr., $d = 8$ hr., and $e = 12$ hr. The necessary temperature gradient inside the sphere of limestone and also the necessary gas temperature is calculated from these figures and also from the above constants for heat transfer and heat conductibility as given in Table II.

The following are the basic formulas for calculating these figures:

$$t_1 - t_2 = \frac{dQ}{\delta \cdot F \cdot Z} \quad \text{and} \quad t_1 - t_2 = \frac{Q}{K \cdot F \cdot Z}$$

where $t_1 - t_2$ = difference in temperature; d = thickness of layer; Q = quantity of heat to be transferred; δ = heat conduction figure; K = heat transfer figure; S = surface, and Z = time.

Preheating

The preheating can be investigated in the same manner. According to the above calculation, the gas temperature is 900 deg. C. at the discharge from the dissociation zone; here the temperature of the limestone is 900 deg. C. at the surface. The limestone is assumed to enter the preheating zone at 0 deg. C.—and a discharge temperature of 270 deg. C. is assumed for the gases. If the entire sphere of 9.622 kg. were heated to 900 deg. C., then it would have to take up a heat quantity of 1814.4 w.e. This heat could be transferred from the gases in $\frac{1814.4}{8 \cdot 0.25 \cdot 180}$ = 5 hr.

Setting the preheating period (somewhat liberally) at 6 hours, the results are as given in Table III.

From these temperatures the following heat quantities are taken up by the individual zones: a = 14 w.e.; b = 103 w.e.; c = 267 w.e.; d = 530 w.e.; e = 873 w.e., a total of 1787 w.e. (The calculation is not entirely correct, since in each case we have started from the heating of the zones to 900 deg. C., and since the necessary higher temperature of the boundary surface was calculated. But the error is exceedingly small, and therefore carries no weight in practice.)

Cooling

The cooling of the burned lime is analyzed in a similar manner. In calculating the dissociation, the temperature of the surface of the sphere was found to be 928 deg. C. when the zone *a* is dissociated. During a uniform decrease of the temperature up to the inside of the sphere (the temperature of which is 900 deg. C.) the individual zones have the following mean temperatures and heat contents:

Zone	Mean temperature, deg. C.	Heat content, w.e.
(a)	902.8	8
(b)	908.4	61
(c)	914	160
(d)	919.6	300
(e)	925.2	499
Total		1028 w.e.

Therefore, 1028 w.e. must be eliminated to the combustion air in the most favorable instance. The air is to enter at 0 deg. C., and the sphere of burned lime is to show a temperature of 10 deg. C. at the surface; the average temperature gradient between the surface of the lime and the combustion air is 250 deg. C. when assuming an air end-temperature of 538 deg. C. The heat content of 1028 w.e. could leave the burned lime in $\frac{1028}{8 \cdot 0.25 \cdot 250}$ = 2 hr. With liberal allowance a cooling period of 4 hr. is used as a basis to get the data shown in Table IV. There remain therefore from 25 to 40.8 w.e. in the burned lime which have not entered the combustion air.

Sources of Heat Loss

These calculations indicate three sources of loss: Temperature of the combustion

TABLE I

Zone dimensions	Volume	Surface area	Weight
(a) r = 2 cm.	32 c. cm.	48 sq. cm.	0.077 kg.
(b) r = 4 cm.	260 c. cm. (a+b)	207 sq. cm.	0.570 kg.
(c) r = 6 cm.	870 c. cm. (a+b+c)	452 sq. cm.	1.465 kg.
(d) r = 8 cm.	2060 c. cm. (a+b+c+d)	800 sq. cm.	2.860 kg.
(e) r = 10 cm.	4000 c. cm. (a+b+c+d+e)	1250 sq. cm.	4.65 kg.
Total			9.622 kg.

TABLE II. THEORETICAL SURFACE AND GAS TEMPERATURES

In dissociation	Temperature at boundary surface deg. C.	Temperature at surface of sphere deg. C.	Gas temperature deg. C.
a	a/b 917.5	928	937
b	b/c 915	945	976
c	c/d 912	947	1000
d	d/e 910	935	1013
e	.....	.....	990

TABLE III. TEMPERATURES IN DIFFERENT ZONES AND ON BOUNDARY SURFACES AFTER SIX-HOUR PREHEATING PERIOD

When heating the zone: No.	Temperature gradient in the zone, deg. C.	Maximum attainable temperature on the boundary surfaces, deg. C.	Average temperature of the individual zones, deg. C.
a	4.8	core 851.7	a 854
b	9.0	a/b 856.5	b 860.5
c	10.2	b/c 865.5	c 870.6
d	11.3	c/d 875.7	d 881.4
e	13.0	d/e 887.0	e 893.5

TABLE IV. HEAT GIVEN UP BY LIME DURING COOLING PERIOD OF TWO HOURS

Zone	Temperature gradient, deg. C.	Mean temperature of individual zones, deg. C.	Heat content of the individual zones, w.e.
(a)	8	98.9	0.8-95
(b)	14.7	76.2	5.1-2
(c)	17.7	50.6	8.7-3
(d)	13.8	36.9	12.4-0
(e)	20.0	25.0	13.6-8

gases greater than 900 deg. C.; portion of the heat of the discharge gas not utilized because the entire quantity of the limestone cannot be heated to 900 deg. C., and the burned lime cannot deliver all its heat to the combustion or burning air.

Just how far these factors exert themselves in actual operation depends upon the extent to which one is able to adhere to the theoretically most favorable requirements. The dissociation period and the burning temperature are always in a close relation. Time and temperature of the waste gases leaving the dissociation zone are essential to the preheating. Time is also of importance in the cooling; if the dissociation period is doubled, lower heating gas temperatures can be used, i.e., one-half the difference between 900 deg. C. and the above values. In this case the waste gases, for example, would leave the dissociation zone at 945 deg. C. Prolonging the preheating period is not of much advantage, for the temperature decrease inside the limestone is only about 50 deg. C. when preheating 6 hours; and the difference between the maximum theoretical heat content to be absorbed and that actually absorbed is only 300 w.e. per kg. $CaCO_3$ or only 1.6%. But the conditions are fundamentally different for shorter preheating periods. For example, in 3 hours a heat volume of 1280 w.e. per sphere of 9.622 kg. weight can be absorbed as compared to 1814.4 w.e. when heating the sphere to 900 deg. C.

The conditions are similar in the cooling of the burned lime. Of course, the heat content of the hot burned lime is comparatively small. We have seen above that 2 hours suffices for the transfer of the heat from the burned lime to the combustion air. But by shortening the cooling time to this period, double the heat volume remains in the lime (81.65 w.e. compared with 40.825 w.e.).

Radiation Losses

In order to consider all factors which have a part in the burning of lime, the quantity of heat lost by radiation from the kiln must be allowed for. As a basis for this calculation gas temperatures for the individual stages of the dissociation as obtained above will be used. A shaft kiln is used for burning; the lining consists of 25 cm. of chamotte brickwork and 7.5 cm. ashes in the sintering and cooling zones, and only chamotte brickwork in the preheating zone. The sheet metal casing may be neglected. The kiln is 21.5 m. high and has an inside diameter of 2 m. The average gas temperatures in the different zones are as given in Table V.

TABLE V. AVERAGE GAS TEMPERATURES IN DIFFERENT ZONES OF A LIME KILN

		Average gas temperature, deg. C.
Preheating zone..	3 m.	673
Dissociation zone	6 m.	990
	4 m.	1013
	3 m.	1000
	2 m.	976
	1 m.	937
Air entrance zone	0.5 m.	673
Cooling zone.....	2 m.	223
	21.5 m.	

The heat in the kiln must overcome the following resistance from the inside of the kiln to the exterior air: Transfer from heating gas to wall; resistance of the chamotte brickwork; resistance of the ash layer; transfer from the exterior wall to the air.

The radiation losses are as follows:

Preheating zone.....	46,033.2 w.e. per hr.
Dissociation zone.....	152,444.2 w.e. per hr.
Cooling zone	4,192.4 w.e. per hr.

The capacity of the kiln is figured at 2.763 tons $CaCO_3 = 1.55$ t. CaO. (Content of ½ m. kiln depth at a 75% utilization of the kiln space.) In the burning of 100 kg. $CaCO_3$ the heat loss by radiation is:

Preheating zone	1675	w.e.
Dissociation zone	5520	w.e.
Cooling zone	152.5	w.e.

For these calculations the radiation loss of the dissociation zone can be assumed to be covered by fuel; the losses of the other zones represent decreases in waste heat.

From the foregoing, it is now possible to present heat diagram or a heat balance for favorable operating conditions.

Theoretical Heat Balance

The total heat used is figured by considering the conditions in operation as compared to the ideal conditions given in the first part of the article. In order to carry out the dissociation reaction, 42,520 w.e. of heat is required per 100 kg. $CaCO_3$; and 5520 w.e. is required to cover radiation losses, giving a total of 48,040 w.e. Since 10,006 w.e. can be recovered from the burned lime, only 38,034 w.e. are really necessary.

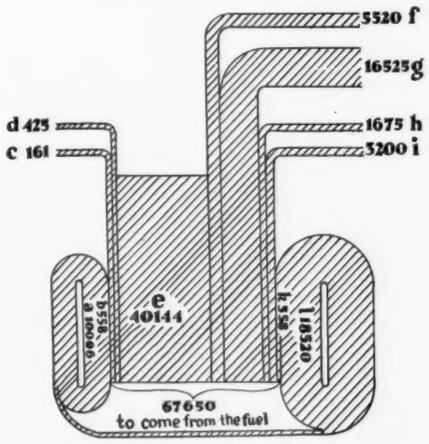


Fig. 3. Heat flow sheet for an efficient lime burning operation typical of the best of modern day plants

Key: a-d, cooling zone; c-f, dissociation zone; g-l, preheating zone.
(a) Heat given up by burned lime.
(b) Heat furnished by impurities.
(c) Non-sensible heat of drawn lime.
(d) Radiation losses in cooling zone.
(e) Heat of dissociation.
(f) Radiation losses in dissociation zone.
(g) Heat lost by waste gases.
(h) Radiation losses in preheating zone.
(i) Heat losses by water evaporation.
(k) Heat transferred to impurities.
(l) Sensible heat recovered from waste gases for preheating limestone.

Available Heat

The average heating gas temperature is 993 deg. C.; accordingly, only that quantity of heat can be utilized from the fuel, which is given to the heating gases above the heat required for reaching this temperature. Of the 8100 w.e. of each kg.C., only 5020 w.e. are available for the dissociation reaction. Therefore, needing 38,034 w.e., the fuel requirement is 7.57 kg.C. (38,034 ÷ 5020).

The weight of the burning gases is 70.2 kg. N plus 27.7 kg. CO_2 or 97.9 kg., to which 44 kg. CO_2 from the dissociation of the limestone is added; the heat value of these gases is:

$$70.2 \times 993 \times 0.258 = 17{,}980 \text{ w.e.}$$
$$71.7 \times 993 \times 0.27 = 18{,}780 \text{ w.e.}$$
$$36{,}760 \text{ w.e.}$$

Of this total, 18,520 w.e. is given to the limestone, and 1,675 w.e. are lost by radiation, so that 16,565 w.e. remain in the gases leaving the kiln. The waste gas temperature is calculated from this to be 448 deg. C.

For preheating the combustion air, 10,003 w.e. are available; and since 90.8 kg. air must be preheated, this air can be preheated to 428 deg. C. Earlier it was shown that impurities in the limestone result in a transfer of excess heat which is contained in the waste gases, to the combustion air, and consequently there results also a decrease in fuel required. The effect of water in limestone was also determined above, as well as the effect of the excess of burning air required in operation. The former conditions are assumed, viz.: 3% impurities, 5% quarry moisture, 10% excess combustion air (although these figures may differ considerably in operation, especially that of excess air).

Heat Unutilized

The impurities take 558 w.e. from the waste gases and transfer this heat to the combustion air; it need not be considered that the impurities in the dissociation zone receive a higher temperature, since the quantity of heat required for this is supplied by fuel and returned to the dissociation zone by the preheating of the combustion air to a higher temperature. However, 1.1% of heat remains in the impurities, so that only 550 w.e. can be utilized in the cooling zone. The 3200 w.e. required for evaporating the water is taken from the waste gas and cannot be used further, and the 10% of excess combustion air lowers the heat content that can be utilized from each kg. of C., to 4723 w.e. Thus the quantity of waste gas increases to 151.7 kg. and its heat content increases to 40,478 w.e.

The heat balance and heat flow sheet as

shown in Fig. 3 take into consideration all the essential factors in the lime burning operation; the various factors have been discussed in detail in the body of this article.

HEAT BALANCE IN LIME KILN

Heat expended (theoretical)		42,520 w.e.
Radiation losses—dissociation zone		5,520 w.e.
		48,040 w.e.
Heat reclaimed from burned lime	10,584 w.e.	
Heat reclaimed from impurities	550 w.e.	
	11,134 w.e.	
Heat losses:		
Retained in lime	425 w.e.	
Cooling zone radiation	153 w.e.	557 w.e. 10,584 w.e.
Total		*38484 w.e.

*Corresponds to 7.94 kg. C. of (8100 — 3377) w.e.

Heat in waste gases		40,478 w.e.
Heat utilized:		
Preheating limestone	18,520 w.e.	
Preheating impurities	558 w.e.	
Evaporation of water in stone	3,200 w.e.	
Loss by radiation	1,675 w.e.	23,953 w.e.
		†16,525 w.e.

†This figure corresponds to a temperature of 414 deg. C. for the gases escaping from the kiln.

The quantity of fuel, 7.94 kg. C. per 100 kg. $CaCO_3$ corresponds to 16.36 kg. of coke of 7000 w.e. per 100 kg. pure CaO, or 15.87 kg. coke, based upon 100 kg. of 97% burned lime. The most favorable fuel consumption figures thus far obtained in large lime plants are already close to the above calculated values.

Bureau of Mines Expands Research Program

THE United States Bureau of Mines, through its mining division, recognized the need for study and research in mining methods, has for some time been active in this phase of study in the metal mining industry. A recent development in this program has been the collection of data and publication of detailed technologic descriptions of various methods used in metal mines. These papers have been prepared by representative engineers engaged in the production of metallic ores and are descriptions of operations, many of which are the result of their own successful study and effort. Many of these papers, while wholly within the field of metal mining, have much of interest and value to the operator of nonmetal mines and quarries.

The enthusiastic response of the operators in preparing these papers and the constant demand for them has encouraged the bureau to extend this type of study to the nonmetallic industries.

To Study Rock Products Operations

As a first step in this program it is planned to accumulate general data dealing with the methods of operation at all nonmetallic deposits. This information will cover the kind of material recovered and produced for market, the characteristics of the deposit, amount of overburden if any, and the method of recovery. Under method of recovery will be recorded general information as to breaking, loading, haulage, and treatment methods and types of equipment used. As this information is accumulated it will be card indexed and cross-referenced in such manner as to form a ready reference file for information used in answering inquiries from the industry. Many times an operator in the field desires information on some specific operating detail of his industry, such as, where certain types of equipment can be seen in actual operation, or where certain methods of mining or treatment are employed. From this fund of accumulated data such inquiries can be answered authoritatively.

Co-operation of Industry Invited

The data so accumulated will be of general interst only, but by the next step in the proposed program it is hoped to supply special studies of details. From this file of general data certain operations will be selected illustrating well defined principles and practices or in some cases how unique conditions are met. Officials of operating companies will be invited to assist in the program by supplying detailed technologic descriptions of their plants compiled in the form of papers following outlines prepared by the bureau. These papers will then be published for distribution by the bureau. By this means data will be accumulated and returned to the industry covering operating details as compiled by the operator himself. By reference to any study of these papers the operators will be better prepared to promote the program of better efficiency and elimination of waste, which is the prime object of the Bureau of Mines.

Data to Be Made Available

The ultimate objective in this program is the accumulation of a mass of available operating data on which to base a comprehensive research program in mining methods. This will cover such subjects as stripping surface deposits with discussions of problems met and methods successfully devised in their solution; drilling problems involving the proper size, spacing and length of drill holes together with the types of equipment used; blasting methods most suitable for different types of deposits and the kind and strength of explosives required. In the same manner methods of loading will be compared and the efficiency of various types of equipment discussed. Dredging operations will be studied in detail together with marine problems in recovering material from underwater deposits. In the same manner the, at present much discussed, problem of internal plant transportation will be studied, such as the relative efficiency of automotive equipment versus the various types of locomotive haul.

Following or coincident with these studies, as personnel and funds permit, the methods of preparing nonmetallic materials for markets will receive attention. This investigation will cover concentration methods, crushing, grinding, screening, washing, elevating, conveying and storage of materials.

Encouraging Research

Much research has been done in the various fields of operating methods but much remains to be done and it is felt this is especially true in the nonmetallic field. Many methods long employed by the metal miner are being adopted by the miner of nonmetallic products and in many instances the metal miner can learn and profit from the experience of the, many times more common, nonmetallic operation.

The object aimed at by such accumulation of operating data and study of details is to provide a library of information at the operator's hand to which he can refer in solving many problems which at present are difficult of solution because of the scarcity of detailed data directly pertaining to the question at hand.

No comprehensive research program can be established without a prior accumulation of all available data. These papers, written by the engineers and officials of operating companies, affording as they must the direct viewpoint of the operator, will furnish this fundamental data on which to base the bureau's research program. Several operating companies have already been approached on this subject and have unanimously subscribed thereto and promised their active support. Already several interesting papers are in preparation dealing with stone quarry methods and sand and gravel pit operations.

J. R. Thoenen has been transferred to the mining division in the bureau and will be in active charge of this program in the nonmetallic field.

Effect of Age on Certain Dynamites

DURING THE PAST FEW years it has been the practice to add to nitroglycerin a certain amount of ethylene glycol dinitrate, which acts as a low-freeze agent, and the Bureau of Mines in serial No. 2923, by A. B. Coates and G. St. J. Perrott, gives the results of tests conducted by the bureau on the relative aging properties of dynamites belonging to this class. These tests are described in detail and the following general conclusions are drawn: (1) Propulsive strength is unaffected by age and is the same for both types of explosives. (2) Sensitiveness to sympathetic detonation is slightly greater in the case of the dynamites containing ethylene glycol dinitrate. (3) Determination of rate of detonation indicates generally that the explosive containing ethylene glycol dinitrates show: (a) slightly higher rates of detonation when unconfined, (b) slightly greater increase of rate when primed with 40% straight nitroglycerin dynamite and (c) slightly better aging properties.

The Cement Institute

A New Organization to Promote Sound Trade Practices in the Portland Cement Industry

THE CEMENT INSTITUTE, an association of manufacturers of portland cement, has established its general offices at 11 East 44th street, New York, N. Y.

The purpose of the institute, as set forth in the articles of the association, are as follows:

Purposes

To promote the best interests of the cement industry by providing facilities for collecting, through voluntary action, information with respect to trade and commerce therein and disseminating such information among the members of the institute and the public generally. The information, so collected and disseminated, shall be as follows:

(a) Information concerning credits.

(b) Information concerning actually closed specific job contracts and other contracts for the future delivery of portland cement.

(c) Information concerning production and stocks on hand of clinker and portland cement and shipments of portland cement and cloth sack returns.

To collect and disseminate such other and future trade information as the institute may determine upon from time to time in accordance with the provisions of these articles of association.

To adopt and promulgate a code of ethics for the government of the members.

To establish and maintain all such lawful trade customs and usages for the protection of the members as the institute may deem advisable.

To adopt lawful plans for the general development and improvement of the industry.

Any person, firm or corporation regularly engaged in the manufacture and sale of portland cement is eligible to membership. Among the members of the institute are the following:

Members

Allentown Portland Cement Co.
Alpha Portland Cement Co.
Ash Grove Lime and Portland Cement Co.
Basic Products Co.
Bessemer Cement Corp.
Consolidated Cement Corp.
Crescent Portland Cement Co.
Cumberland Portland Cement Co.
Dewey Portland Cement Co.
Edison Portland Cement Co.
Florida Portland Cement Co.
Georgia Cement and Products Co.
Giant Portland Cement Co.
Glens Falls Portland Cement Co.
Hawkeye Portland Cement Co.

Blaine S. Smith, president, The Cement Institute

Hercules Cement Corp.
Hermitage Portland Cement Co.
Lehigh Portland Cement Co.
Lone Star Cement Co., Alabama.
Lone Star Cement Co., Indiana.
Lone Star Cement Co., Kansas.
Lone Star Cement Co., Louisiana.
Lone Star Cement Co., New York, Inc.
Lone Star Cement Co., Pennsylvania.
Lone Star Cement Co., Virginia.
Manitowoc Portland Cement Co.
Medusa Portland Cement Co.
Missouri Portland Cement Co.
Monarch Portland Cement Co.
National Cement Co.
Nazareth Cement Co.
Newaygo Portland Cement Co.
Northwestern States Portland Cement Co.
Oklahoma Portland Cement Co.
Peerless Cement Corp.
Pennsylvania-Dixie Cement Corp.
Petoskey Portland Cement Co.
Pittsburgh Plate Glass Co.
Signal Mountain Portland Cement Co.
Southern States Portland Cement Co.
Southwestern Portland Cement Co.
Trinity Portland Cement Co.
Volunteer Portland Cement Co.
Vulcanite Portland Cement Co.
Wabash Portland Cement Co.
Wellston Iron Furnace Co.
West Penn Cement Corp.
Wolverine Portland Cement Co.

Officers

The officers of the institute are:

President, Blaine S. Smith, president, Pennsylvania-Dixie Cement Corp.; vice-president and treasurer, Morris Kind, president, Hercules Cement Corp.; vice-president, M. C. Monday, president, Hermitage Portland Cement Co.; vice-president, Charles Irvin, vice-president, Alpha Portland Cement Co.; vice-president, J. A. Lehaney, vice-president and manager, Lone Star Cement Co. (Kansas).

The above officers, together with the following, are members of the board of trustees: G. S. Brown, president, Alpha Portland Cement Co.; George F. Coffin, treasurer and general manager, Nazareth Cement Co.; Charles Schmutz, vice-president, Bessemer Cement Corp.; Col. E. M. Young, president, Lehigh Portland Cement Co.

In addition to this New York office, the institute has offices at present in Chicago, Ill., and Kansas City, Mo. Col. Wm. J. Donovan is counsel for the institute; Luther G. McConnell is general manager of the institute; George H. Reiter is manager of the Chicago division, and Baxter D. McClain is manager of the Kansas City division. The code of ethics as adopted by the institute is as follows:

Code of Ethics

The portland cement industry fills an important and necessary place in the country's economic structure. It owes a duty to the public and also to its own stockholders. This duty includes the obligation to deal fairly with labor, to manufacture its product efficiently, to promote its proper use, and, as far as possible, to prevent its improper use, to eliminate waste, to sell at a fair price, to develop new uses, to approve and encourage sound and fair trade practices in business and to condemn and prevent bad and unfair practices. To that end competition should be open and constructive, not secret and destructive.

With these purposes in mind, the undersigned manufacturers of portland cement have compiled, in a concise and understandable form, the following rules and regulations into this code of ethics, and hereby agree to be bound thereby.

STANDARDIZATION OF PRODUCT

Due largely to the activity of the Bureau of Standards and other bureaus of the United States government, the benefit to all concerned, of standardization, is generally recognized. Portland cement was one of the first important commodities for which a generally accepted standard specification was

developed and today practically all portland cement is manufactured, sold and used under the uniform Standard Specifications of the United States government, the American Society for Testing Materials and the American Standards Association.

Freak and unreasonable specifications increase costs not only of manufacturer but of dealer and user as well; they also tend to destroy confidence in a standard specification, and, not being in the public interest, should be discouraged.

Therefore, it is declared that all portland cement manufactured and sold shall be guaranteed to meet the existing standard specifications of the American Society for Testing Materials, the American Standards Association and the United States Government Master Specifications; that cement manufacturers shall not be responsible for the improper use of cement, and therefore shall not guarantee finished work.

Failure of any manufacturer to observe these declarations shall be considered an unfair trade practice.

It is, of course, the privilege, and in some cases the custom of purchasers or users, to make sure that the guarantee of manufacturers is fulfilled by employing commercial testing laboratories to sample and test cement; arrangements for the service and the charge therefor are made between the laboratories and the cement purchasers or users, and for any manufacturer to pay or absorb such charges, directly or indirectly, shall be considered an unfair trade practice, unless at the same time the manufacturer shall publicly offer to pay or absorb such charges for all purchasers or users.

STANDARDIZATION OF SALES CONTRACT

The making of incomplete, ambiguous and deceptive contracts for the sale of portland cement provides a medium for making unfair price discriminations, induces fraud and repudiation of such contracts, gives rise to disputes and disturbs stability in business operation, to the consequent injury of the industry and the general public.

Therefore, it is declared that all contracts for the sale of portland cement shall contain a definite statement of price, quantity, terms of payment, time and place of delivery and all other items necessary to form a complete contract; further, that all contracts so entered into shall be performed in letter and in spirit.

The industry hereby records its approval of the practice of manufacturers in establishing definite terms of sale, and adhering thereto, and the continued violation by a manufacturer of its terms for the purpose or with the effect of price discrimination is condemned.

It is further declared, that it is desirable that a standard form of sales contract be drafted and adopted for the use of the portland cement industry.

PRICE DISCRIMINATION

The practice of manufacturers' quoting different prices at the same time to purchasers or users similarly situated is unfair to purchasers or users and to competing manufacturers.

Therefore, it is declared that no discrimination shall be made in price, or terms and conditions of sale as between purchasers or users in the same class except as provided by the Clayton act.

It is further declared that in order to carry out the above declaration, each manufacturer shall, especially when changes in its prices and terms or conditions of sale occur, make its prices and all terms and conditions of sale public by broadcast quotations to the trade so that interested members of the trade and buying public may at all times have accurate information.

SECRET REBATES AND PRICE CONCESSIONS

The payment or allowance of secret rebates, refunds, credits or unearned discounts, etc., tends to demoralize both the buyers and sellers of cement and to promote dishonest and unfair competition.

Therefore, it is declared that no manufacturer shall pay or allow any secret rebate, refund, credit or unearned discount, whether in the form of money or otherwise; nor shall any manufacturer extend to particular purchasers or users special services or privileges not extended at the same time to all purchasers or users similarly situated; nor shall any of these practices be carried out directly or indirectly by the manipulation of accounts or records so as to cover up actual conditions.

In order to carry out the principle stated above, the following specific matters, in addition to the above statement, shall be regarded as secret rebates and price concessions:

1. The sale by any manufacturer of any commodity, other than cement, manufactured or handled by such manufacturer at a discriminatory price for the purpose, or with the effect, directly or indirectly, of furthering the sale of a particular brand of cement.

2. The purchase, by any manufacturer, of bonds, or other securities, issued for the financing of construction work, either in the name of the manufacturer, or its subsidiaries, or of individuals, or officers, connected therewith, for the purpose, or with the effect, of influencing the sale or use of a particular brand of cement, or the acceptance of such bonds, or other securities, in payment, wholly or in part, for cement.

3. The purchase, by any manufacturer, of fuel, or other supplies, either in the name of the company, or its subsidiaries, or of individuals, or officers connected therewith, at premium prices above the fair market price of such commodities at the time of purchase for the purpose, or with the effect, of influencing the sale or use of a particular brand of cement.

4. Lavish, excessive or undignified entertainment of purchasers or users of cement, or others concerned therewith, with the intent to influence the purchase or use of a particular brand of cement, provided that moderate and dignified entertainment shall be permitted, such, for example, as is incident to the conducting of cement purchasers or users, and others, through cement manufacturers plants.

5. Donating funds, or providing banquets or other similar lavish entertainments for purchasers or users, or associations thereof, to influence the purchase of a particular brand of cement.

6. Giving, or offering to give, premiums, personal gifts, gifts of cement, or gifts of any other commodity of substantial value to purchasers or users of cement with the intent or effect of influencing the purchase of cement. Provided, however, that nothing herein contained shall prevent any manufacturer from conducting a bona fide advertising campaign involving the presentation to purchasers or users, of commodities of moderate value bearing the name of the donor thereon.

7. The payment, or offer to pay, directly or indirectly, any advertising expenses of purchasers or users of cement, unless at the same time the same, or a similar payment, or offer, is made to all other purchasers or users in substantially the same circumstances.

8. The omission from or inclusion in an invoice of any fact, or facts, which make it a false record, in whole or in part, of the transaction represented on the face thereof, including the invoicing of a less quantity than the actual amount, the antedating or post-dating of the invoice, the refunding of any amount to purchasers or users, unless it is clearly shown for what reason such refund is made, and that such refund is legitimate.

9. The sale of cement below cost, for the purpose, or with the effect, of injuring a competitor, or of lessening competition, except that cement may be sold below cost to meet a competitive market price.

10. The prepaying of railroad freight charges on shipments consigned to other than the cement manufacturer itself, except in the case of freight charges to railroad stations to which railroad regulations require prepayment from any mill, or the payment of railroad demurrage charges by any manufacturer, with the purpose or effect of giving or granting to any particular purchasers or users a special privilege, rebate or concession, not offered to all other purchasers or users under substantially the same circumstances, is an unfair trade practice.

11. The payment or allowance, by any manufacturer, of freight charges to purchasers or users, by any means whatosever, of an amount in excess of the actual amount provided by transportation company's published tariff rates, is an unfair trade practice.

12. The payment, credit or allowance, by any means whatsoever, by any manufacturer for more, or less, cloth sacks returned by purchasers or users than such purchasers or users are actually entitled to credit or allowance for under the manufacturer's published terms and conditions of sale is an unfair trade practice; and the purchase, payment or allowance, by any means whatsoever, by any manufacturer, for damaged sacks which are not in serviceable condition, or which a reasonable amount of repair will not put in serviceable condition for further use as cement containers, or the purchase, payment or allowance, by any means whatsoever, for sacks bearing other than a manufacturer's own brand, when to do so is different from or contrary to the terms and conditions of sale of any such manufacturer, is an unfair trade practice.

13. The failure of any manufacturer to charge and to require purchaser or user to pay the manufacturer's published charges covering cloth sacks and paper bags is an unfair trade practice.

14. For manufacturers to divert, or to permit purchasers or users of cement to divert, carload shipments of cement, made to one destination, to other destinations in cases where the result of such diversion is to enable purchasers or users of cement to secure cement less than the manufacturer's market price at the point of final delivery is discriminatory as between purchasers or users, and is therefore an unfair trade practice.

OTHER UNFAIR TRADE PRACTICES

Many unfair and reprehensible trade practices have sprung up, from time to time, in the cement industry. It is the earnest desire of the industry to eradicate these practices in order that the cement business may be conducted honestly, openly and fairly.

Therefore, it is declared, that the following specific trade practices are unfair and are hereby condemned:

1. The willful interference, by any means or device whatsoever, with any existing sales contract between a manufacturer and its customer, with the purpose, or effect, of inducing, or causing a breach of such contract. Whenever notice of the existence of a contract is brought to the attention of any manufacturer, or his representative, he shall

promptly discontinue all efforts which might induce a contracting party to break such contract.

2. The defamation or disparagement of a competitor by words or acts which untruthfully call in question his business integrity, his ability to perform his contracts, his credit standing or the grade, quality, count or weight of his products.

3. The enticement of the employes of a competitor with the intent or effect of interfering with the conduct of the business of such competitor.

4. The making, causing or permitting to be made or published any false, untrue or misleading statement by way of advertisement or otherwise concerning grade, quality, character, nature, origin, manufacture or preparation of products is unfair trade practice.

DEFINITIONS

The term "cost" when used in this code of ethics shall be interpreted to include, among other items, the following: Cost of raw materials, transportation thereof, manufacture, packing and loading and sack losses, depreciation, depletion, obsolescence, selling and administrative expenses, fair return on total invested capital.

The term "purchasers or users," when used in this code of ethics, shall be interpreted to include both actual and prospective purchasers or users as follows: dealers, architects, engineers, contractors, concrete products plants, railroads, central mixing plants, United States, state, county and municipal governments, including regularly constituted boards and commissions thereof, commercial, industrial and manufacturing concerns, public officials, public utilities, etc.

The term "sales contract" as used in Article V, Section 1, shall be understood to be any bona fide agreement in writing between manufacturer and purchaser or user, covering the purchase and sale of cement, containing a definite statement of price, quantity, terms of payment, time and place of delivery and all other items necessary to form a complete and unambiguous contract.

VIOLATIONS OF THIS CODE OF ETHICS

The violation of any of the above rules or declarations or any of the provisions of this code of ethics shall be deemed to be an unfair method of competition.

Contract Made Illegally Is Validated by State Acceptance of Performance

A SUBCONTRACT made in violation of a state statute requiring the written permission of the particular state department, party to the contract, has been held by the Supreme Court of Nevada to be merely voidable and not entirely void.

The court declared that the provision for written permission was incorporated into the statute for the benefit of the state. It does not provide, the opinion explains, "that a subcontract not so approved in writing shall be void. In this situation we think it is a condition which even the state may waive."

Following out this rule the court concluded that a subcontractor, a party to a subcontract so made, could not sue the contractor and his surety upon the quantum meruit for goods delivered under the subcontract and that the measure of damages due to the contractor on a counterclaim is the difference between what he would have received from the particular department of the state and what he would have paid the subcontractor had the latter fully performed according to the terms of the contract.

Dan H. Leech et al. instituted this action to recover judgment in the sum of $10,318.15, a balance alleged to be due from the defendant M. P. Armstrong for work and labor performed.

This litgation grew out of this state of facts: On October 10, 1922, the highway department of the state of Nevada, hereinafter referred to as the Highway Department, entered into a contract with Armstrong, designated contract 65, whereby it was agreed: ". . . the party of the first part (Highway Department) hereby purchases of and from the party of the second part (Armstrong), and the party of the second part hereby sells and agrees to deliver to the party of the first part . . . the quantities of crushed rock as set forth in the following schedule: . . . It is agreed that the material to be secured from the proposed quarry site leased by the department at Vista meets the specifications and is satisfactory as to quality."

The contract contains provisions for the erection by Armstrong at or near Vista siding, in Washoe county, of a crushing plant of sufficient capacity to crush 300 tons per day, and that Armstrong should load such crushed rock on board cars for a certain sum per ton.

The contract further provides that in case of the failure of Armstrong to deliver crushed rock at the rate and in quantities provided for, the Highway Department might declare the contract forfeited. It also contains a provision against subletting except with the written consent of the Highway Department.

Armstrong erected his crushing plant and for a time delivered crushed rock. He then entered into a subcontract with the plaintiffs whereby they agreed to deliver the crushed rock at a price per ton considerably less than that to be paid Armstrong.

The contract between plaintiffs and Armstrong, by its terms, incorporated into it all of the provisions of the contract between Armstrong and the Highway Department.

The defendant bonding company was made a party because of the fact that it was surety on Armstrong's bond.

Pursuant to said subcontract the plaintiffs took possession of the crusher and outfit and for a time operated it and delivered the crushed rock on board the cars as provided in the original contract. Later, failing to make delivery as provided in said contract, the Highway Department declared the contract forfeited.

The plaintiffs instituted this action to recover for the alleged value of the work and labor performed in crushing and delivering the rock that was delivered, rather than on the contract between them and Armstrong. Armstrong filed an answer denying all liability and pleaded a counterclaim based upon the contract, alleging damage as a result of the failure of the plaintiffs to make delivery of the rock as agreed, and also sought to recover for money paid out on behalf of the plaintiffs.—*United States Daily.*

Nordstrom Valve Slogan Contest

INDICATING the intense interest aroused by the recent slogan contest held by the Merco-Nordstrom Valve Co., 11,275 slogans were received by the manufacturers over a period of approximately 60 days, according to H. S. Shuey, secretary.

The Merco-Nordstrom Valve Co. offered $500 in prizes for the best slogans pertaining to Nordstrom valves and contributions were received from every state in the Union and several hundred from foreign countries.

The jury of awards exercised great care in checking over the mass of slogans and each was read by the jury and given consideration. From more than 11,000, 19 were finally selected for the prizes. The grand award was given to J. L. Pillow of the Standard Oil Co., Baton Rouge, La., who contributed the following slogan: "Nordstrom—The Perfect Application of a Principle."

The second award was made to G. E. Genung, 13326 Terry Ave., Detroit, Mich., the slogan being "Hydraulic Lubrication Insures Effective Manipulation."

The remaining 17 slogans selected in order of their preference were as follows:

"Fabricated and Lubricated for Long Life"—G. C. Bemis, Jr.

"Won't Leak, Won't Stick, Lubrication Does the Trick"—T. S. Barlow.

"The Valve Controls the Flow," the Screw Controls the Valve"—Henry A. Webber.

"The Turn of a Screw Pushes Lubricant Through"—Hal D. Draper.

"Nordstrom's Perfection Is Your Protection"—Russell Egbert.

"For Those Whose Goal Has Been Control"—Arthur Atkins.

"Nordstrom's Lubricated Action Is the 'Seal' of Satisfaction"—S. St. Claire.

"Bringing Pressure to Bear on Valve Troubles"—Albert S. Eggleton.

"Will Stand the Strain on Any Main"—Fred J. Maples.

"Simple to Lubricate, Easy to Operate"—G. W. Martindale.

"They Lubricate as They Operate"—Edith M. Bell.

"Loosened and Tightened by Lubricant"—L. D. Nicolson.

"Where Nordstroms Go In Troubles Go Out"—E. J. Shaunce.

"With Every Connection Comes Your Protection"—C. G. Schram.

"Once Installed Never Stalled"—Charles W. Smith.

"Made Their Way by the Way They're Made"—E. D. Murphey.

"Satisfaction at Every Turn"—C. Wilkes.

Editorial Comment

Enforcing Fair Business Practices

The portland cement industry has condemned certain unfair practices, or better, it has adopted, or subscribed to, at least by inference, a code of fair business practices—a method of doing business decently; and it is to be hoped profitably. The medium is the Cement Institute. Apparently it has not sought the assistance of the Federal Trade Commission. It is to be hoped that the cement industry will not seek such assistance. ROCK PRODUCTS would like to see one of its industries proceed on its own initiative and on its own responsibility. For one, we believe the importance of the Federal Trade Commission factor in the enforcement of such codes has been much over-rated. The more Federal Trade Conferences we see, the more we are convinced of it. For in the last analysis the actual adoption—the absorption of the principles of such a code—rests with the understanding, the intelligence and honor of its subscribers. The portland cement industry has properly named its medium *an institute*.

An institute is defined as a corporate body or establishment instituted for public use; an established order, system of laws or of polity; an established principle, rule or order. What could be more appropriate? A business institute established for public use designed primarily to codify decent business practices and to enforce them by education and an appeal to the honor of educated and enlightened business men! Does it help honorable men to observe a code that they know defines practices honor binds them to observe by putting a policeman on the job?

Doubtless the Federal Trade Commission has done a great public service in having started the present movement to establish such codes. It has done good work in helping call the attention of business men to many common business abuses that are actually unlawful. It may have been of assistance in some instances in actually enforcing such codes. But we fail to see where the Federal Trade Commission or a Federal Trade Conference is essential to the elimination of unfair business practices, where all involved are intelligent enough to be unanimous in condemning.

The chief function of the Federal Trade Commission in recent trade practice conferences seems to have been merely as legal advisor on what rules or resolutions are likely to pass the test of the courts and what are not. It may be exceptionally well qualified to do this. But there are other sources of legal advice besides the Federal Trade Commission, probably equally reliable, and very likely less conservative. Necessarily the Federal Trade Commission is conservative; the weight of its opinion, because it is an arm of the government, is very great, at least in its own estimation. After a brave start its codes have been continually boiled down to a few general principles which are as applicable to one industry as to another.

Yet every industry has its own particular abuses besides these general ones. In a trade practice conference there is little opportunity to obtain resolutions or rules covering these. They are too specific. They are too close to the border line of illegality to obtain the sanction of the Federal Trade Commission. But they contain the essence of the things that the industry needs to rid itself of. And just where the border line of illegality comes can't be precisely determined, even by the Federal Trade Commission itself. It is naturally inclined to stick safely a good ways from it.

Take the matter of price-cutting, or, as it is politely called, "selling below cost." It is condemned by the Federal Trade Commission, only when resorted to, to injure a competitor. Theoretically a producer may give away his output if he sees fit, provided it is not done to injure a competitor. Whatever his intentions—and what court of law can read a man's thoughts or interpret his intentions?—his competitors *are* injured. His own business in injured. The public is injured by upsetting stable business conditions and by causing bankruptcies, loss of profits, of wages, of government income. It should be condemned because of its inevitable evil economic effects, as an unfair and unsound practice. Business law, as now interpreted by the highest courts, is being considered in the light of economics as well as of precedents. Why shouldn't business and industry take the initiative in a definite stand and champion the cause of sound business economics?

Again, one of the chief causes of bad business in the rock products industry is dumping in markets beyond the normal market territory of producing plants. Producers do it to get volume—for volume is the one big thing that reduces cost; at least it is the quickest and easiest way to reduce cost. Dumping is fundamentally unfair and unsound because it always results in competitors fighting fire with fire, in speeding up their own production to reduce costs to the same level, and in dumping in the first offender's market or some other's. The result of course is price-cutting, all around, with everybody's costs going back to their original level, since if everyone practices dumping, there is no more total business than before, but the margin for all between cost and price has been destroyed. Who gains? Certainly not the industry nor the public, because sooner or later in some form both must foot the bill. And that bill includes freight and distribution costs all out of proportion to the total volume of business done.

However, the Federal Trade Commission cannot approve resolutions condemning dumping—not in localized industries like these—because, it is alleged, to do so is equivalent to a division of territory; and that, by collective agreement, is in direct conflict with the anti-trust laws. The only hope of such a resolution surviving scrutiny by the Federal Trade Commission is to so word it as to condemn dumping purposely done to injure a competitor or to restrict competition. Dumping is probably seldom resorted to in

the rock products industry for either of these purposes—even granting the purpose could be definitely established at law—it is done from a mistaken understanding of the law of self-preservation. A producer should not engage in dumping and price-cutting, because it will prove his own ruin as well as others' if persisted in. Its obvious evil economic effects are sufficient reason for its condemnation.

All the public asks of business and industry is that they be fair and not gouge, even if opportunity does offer. Business and industry have learned it does not pay to gouge, or otherwise purposely injure the public. The public expects business to prosper, to pay wages, to give employment, to pay fair dividends. The government needs prosperous industry to provide its own financial support. In the last analysis public opinion not only makes the laws, but interprets them. Courts as well as legislatures are ruled by public opinion. It is time for courageous industry to do away with hypocrisy and come out openly in defense of measures that are and must be taken to make business prosperous, to rely on intelligent public opinion to justify them, to trust that the law will be interpreted in favor of these necessary measures, and not inevitably against all attempts to conduct business intelligently, if done openly, fairly, honorably and honestly.

Even at this moment it is an even break whether abolition of these practices be decided against the law or not. If producers would be honorable and honest with the public, let them begin by being honest and honorable with each other. It seems to us that in any court of honorable gentlemen this would be the best defense against an alleged conspiracy to injure the public—for can there be an honest conspiracy, or a conspiracy of honorable men?

General Conference on Feldspar

PURSUANT to a request of the Feldspar Grinders Institute, a general conference on feldspar was held recently at the Bureau of Standards, Washington, D. C. The purpose of this conference was the establishment of the industry's own classification for grades of feldspar by and with the co-operation of grinders, distributors and consumers in order to arrive at a common basis of understanding in every day trade. A proposed standard developed by the Feldspar Grinders' Institute was used as the basis of discussion.

E. L. Bacher, manager of the foreign commerce department of the United States Chamber of Commerce, gave an interesting talk on foreign markets for feldspar. He considered the foreign market a new field for this product. It was decided to appoint a committee to study the matter further. W. J. Parker, commissioner of the Feldspar Grinders' Institute, read a plan presented by G. F. Brown, insurance counsel, which outlined the establishment of a department within the institute which would have for its objectives the purchasing of insurance for each member, seeking the best markets for their particular needs, thereby obtaining better markets for their particular needs, thereby obtaining better service, better production and better coverage. The plan was considered and discussed and a committee was designated to make a further investigation, having in mind particularly the liability insurance of the members.

Advance in Federal Road Fund Assured

THE FEDERAL AID HIGHWAY bill (H. R. 5616), increasing the annual appropriations for state road construction from $75,000,000 a year as at present to $125,000,000 for each of the next three years, was passed January 21 by the House under a special rule. The bill now goes to the Senate.

In several hours of debate there was no opposition, but some objections to certain details, including a $30,000 limitation in the law under which the maximum federal advance per mile is $15,000 to be matched by the particular state's expenditure of an equal amount per mile.

Representative Selvig (Rep.) of Crookston, Minn., told the House his state is in a position to meet any appropriation Congress sees fit to authorize.

Granite Quarries Association Holds Convention

THE National Building Granite Quarries Association recently held its annual convention at Norfolk, Va. Reports of business during the past year by members of the association showed a 30% increase in 1929 over 1928. This is the largest advance in a single year since 1925.

Dr. G. F. Loughlin, head of the metalliferous deposits sections of the United States Geological Survey, the principal speaker, reviewed the industry in brief and urged the importance of further educating the public.

The association unanimously passed a resolution calling upon the geological survey to make a survey of the granite industry in the United States.

J. F. Sargent, of Mount Airy, N. C., was elected president of the association, succeeding Guy A. Swenson, of Concord, N. H. Other officers elected were M. L. Button, of Stonington, Me., vice-president; Bradford C. Patch, of Boston and Barre, Vt., treasurer, and Harrie H. Sherman, of Boston, executive secretary.

Members of the board of directors named are: G. A. Bailey, Mount Airy; James Booth, New London, Conn.; M. L. Button, Boston; Frank A. Emery, North Jay, Me.; F. I. Hardy, Burlington, Vt.; C. H. Rogers, Rockport, Mass.; J. D. Sargent, Mount Airy; J. C. Patch, Boston; O. S. Swenson, Concord, N. H., and E. L. Kittridge, Milford, N. H.—*Danville* (Va.) *Register*.

Cement and Crude Gypsum Put on Free List

THE United States Senate recently voted to replace hydraulic cement on the free list of the pending tariff bill (H. R. 2667), adopting the McMaster amendment, after several hours of debate, which makes such provision, by a vote of 40 to 35. It also rejected a proposal to levy a duty of 75 cents a ton on crude gypsum, now on the free list, by a vote of 62 to 9. Elimination of a previously approved increase in the duty on calclined and ground gypsum then was voted, 49 to 17. This restored the present levy of $1.40 a ton.

This action strikes from the bill the House language to provide a duty of 8 cents per 100 lb. on hydraulic cement. The Senate finance committee had left the House language unchanged.

The wording of the amendment, sponsored by Senator McMaster (Rep.) of South Dakota, restores existing law, leaving white, non-staining portland cement duitable at 8 cents per 100 lb. and permitting free entry to hydraulic cement. The countervailing duty of existing law also was restored.

Rainfalls and Working Days in Road Construction

ONE of the papers at the recent convention of the American Road Builders Association at Atlantic City is "A Survey in the 48 States of Weather Conditions, Working Days, Bonus and Penalty Requirements," by C. N. Conner and P. F. Seward. The paper includes a map showing the average annual rainfall in various parts of the country, and table of the average number of outside working days per year in each state. The map and table should be interesting and possibly helpful to rock products producers in estimating the possibilities or probabilities of their own working seasons. Some rather surprising facts are brought out in graphical form, regarding different parts of the country.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	1-28-30	94	96	
Alpha P. C. new com.	2-10-30	29½	30	75c qu. Jan. 15
Alpha P. C. pfd.	2-10-30	110	.....	
American Aggregates com.[39]	1-28-30	15	20	75c qu. Mar. 1
Amer. Aggregate 6's, bonds	2- 7-30	84	.....	
American Brick Co., sand-lime brick	2-10-30	.....	12	25c qu. Feb. 1
American Brick Co. pfd., sand-lime brick	12-13-29	.....	80	50c qu. Feb. 1
Am. L. & S. 1st 7's[29]	1-28-30	94	97	
American Silica Corp. 6½'s[49]	2-11-30	No market		
Arundel Corp. new com.	2-10-30	43¾	44	75c qu. Jan. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	2-11-30	No market		
Atlas P. C. com.[2]	2-10-30	33	37	
Beaver P. C. 1st 7's[20]	1-10-30	.....	100	
Bessemer L. & C. Class A[4]	2-10-30	32¼	32½	75c qu. Feb. 1
Bessemer L. & C. 1st 6½'s[4]	2-10-30	91½	95	
Bloomington Limestone 6's[29]	1-28-30	75	85	
Boston S. & G. new com.[47]	2-10-30	16½	19½	40c qu. Jan. 1
Boston S. G. new 7% pfd.[47]	2-10-30	46	50	87½c qu. Jan. 1
Calaveras Cement 7% pfd.	2- 7-30	85	87	1.75 qu. Jan. 15
Calaveras Cement com.	2- 7-30	12½	15¾	
Canada Cem. com.	2-10-30	15¾	16½	
Canada Cement pfd.	2-10-30	93	94	1.62½ qu. Dec. 31
Canada Cem. 5½'s[43]	2- 7-30	98¼	99	
Canada Cr. St. Corp. 1st 6½'s[43]	2- 7-30	95	.....	
Can. Gyp. & Alabastine (new)	2-10-30	24	24½	37½c qu. Jan. 2
Certainteed Prod. com.	2-10-30	14¼	14½	
Certainteed Prod. pfd.	2-10-30	40	59½	1.75 qu. Jan. 1
Cleveland Quarries new st'k	2-10-30	.....	69	
Columbia S. & G. pfd.	2-11-30	85	.....	
Consol. Cement 1st 6½'s, A	1-28-30	75	85	
Consol. Cement 6½% notes[24]	2-11-30	80	90	
Consol. Cement. pfd.[29]	1-28-30	50	60	
Consol. Oka S. & G. 6½'s[42] (Canada)	1-25-30	98	100	
Consol. Rock Prod. com.[5]	2- 6-30	2½	5	
Consol. Rock Prod. pfd.[5]	2- 6-30	22½	25	
Consol. S. & G. com. (Can.)[38]	2- 8-30	No market		
Consol. S. & G. pfd. (Can.)	2-10-30	86½	.....	1.75 qu. Feb. 15
Construction Mat. com.	2-10-30	19¼	21	
Construction Mat. pfd.	2-10-30	38	39½	87½c qu. Feb. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	2- 6-30	91	97	
Coosa P. C. 1st 6's[29]	1-28-30	50	53	
Coplay Cem. Mfg. 1st 6's[40]	2-10-30	90	.....	
Coplay Cem. Mfg. com.[40]	2-10-30	10	.....	
Coplay Cem. Mfg. pfd.[40]	2-10-30	70	.....	
Dewey P. C. 6's (1942)	2-11-30	96	.....	
Dewey P. C. 6's (1930)	2-11-30	96	.....	
Dewey P. C. 6's (1931-41)	2-11-30	96	.....	
Dolese & Shepard	2-10-30	80	83	$2 qu. & $1 ex. Jan. 2
Edison P. C. com.[30]	2-10-30	10c	.....	
Edison P. C. pfd.[30]	2-10-30	25c	.....	
Giant P. C. com.[2]	2-10-30	.....	20	
Giant P. C. pfd.[2]	2-10-30	.....	30	
Hermitage Cement com.	2-11-30	15	20	
Hermitage Cement pfd.	2-11-30	65	75	
Hermitage Cement 6's	2-11-30	101	104	
Ideal Cement, new com.[33]	2- 8-30	57	59	50c spec., 50c ex. Dec. 21 & 75c qu. Jan. 1
Ideal Cement 5's, 1943[33]	2- 8-30	95	100	
Indiana Limestone com.[29]	1-28-30	2	5	
Indiana Limestone pfd.[29]	1-28-30	.....	50	
Indiana Limestone 6's	2-10-30	70½	.....	
International Cem. com.	2-10-30	59¼	60	$1 qu. Dec. 31
International Cem. bonds 5's	2-10-30	93¾	94	Semi-ann. int.
Iron City S. & G. bonds 6's[46]	1-24-30	80	.....	
Kelley Is. L. & T. new st'k	2-10-30	40	43	62½c qu., 50c ex. Jan. 1
Ky. Cons. St. com. V. T. C.[48]	2- 6-30	12	13	
Ky. Cons. Stone 6½'s[48]	2- 6-30	95	100	
Ky. Cons. Stone pfd.[48]	2- 6-30	89	92	
Ky. Cons. Stone com.[48]	2- 6-30	12	13	
Ky. Rock Asphalt com.	2-11-30	15	17	
Ky. Rock Asphalt pfd.	2-11-30	89	91	
Lawrence P. C.	2-10-30	55	60	
Lawrence P. C. 5½'s, 1942	2- 5-30	84	90	
Lehigh P. C.	2-10-30	36	37	52½c qu. Feb. 1
Lehigh P. C. pfd.	2-10-30	106	107	1¾% qu. Jan. 2
Louisville Cement[7]	2-10-30	230	.....	
Lyman-Richey 1st 6's, 1932[13]	11-18-29	96	99	
Lyman-Richey 1st 6's, 1935[13]	11-18-29	95	98	
Marblehead Lime 6's[14]	2- 8-30	95	98	
Marbelite Corp. com.	2- 7-30	225	300	
Marbelite Corp. pfd.	2- 7-30	11	15	
Material Service Corp.	2-10-30	21	23⅞	50c qu. Mar. 1
Medusa Portland Cem.[29]	1-28-30	105	115	1.50 Jan. 1
Mich. L. & C. com.[6]	2-10-30	30	.....	
Missouri P. C.	2-10-30	33½	34	50c qu. Feb. 1
Monolith Portland Midwest[9]	2- 7-30	4	5	
Monolith bonds, 6's[9]	1- 9-30	97½	100	
Monolith P. C. com.[9]	2- 7-30	9	10	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	2- 7-30	7½	8	40c s.-a. Jan. 1
Monolith P. C. units[9]	2- 7-30	25	28	
National Cem. (Can.) 1st 7's[43]	2- 7-30	99¼	.....	
National Gypsum A com.	2-10-30	8	9	
National Gypsum pfd.	2-10-30	35	40	
Nazareth Cem. com.[26]	2- 7-30	20	24	
Nazareth Cem. pfd.[26]	2- 7-30	98	.....	
Newaygo P. C. 1st 6½'s[29]	1-28-30	101½	102½	
New Eng. Lime 1st 6's[14]	2- 8-30	90	95	
N. Y. Trap Rock 1st 6's	2-10-30	95	.....	
N. Y. Trap Rock 7% pfd.[36]	2- 7-30	95	.....	
North Amer. Cem. 1st 6½'s	2- 8-30	55	.....	
North Amer. Cem. com.[22]	2- 7-30	3	6	
North Amer. Cem. 7% pfd.[22]	2- 7-30	23	28	
North Amer. Cem. units[29]	1-28-30	20	25	
North Shore Mat. 1st 5's[15]	2-11-30	95	.....	
Northwestern States P. C.[37]	2-10-30	130	140	$2 Jan. 1
Ohio River Sand com.	2-10-30	19	20	
Ohio River Sand 7% pfd.	2-10-30	98½	102	
Ohio River S. & G. 6's[16]	2-10-30	90	95	
Pacific Coast Cem. 6's[5]	2- 6-30	80	85	
Pacific P. C. com.	2- 7-30	27	30	
Pacific P. C. pfd.	2- 7-30	78	81	1.62½ qu. Jan. 5
Pacific P. C. 6's[5]	2- 6-30	99¼	.....	
Peerless Cem. (new) com.[21]	2-10-30	9	11	
Peerless Cem. pfd.[21]	2-10-30	82	85	1.75 Dec. 31
Penn-Dixie Cem. pfd.	2-10-30	39	40⅞	
Penn-Dixie Cem.com.	2-10-30	7	7⅛	
Penn-Dixie Cem. 6's	2- 8-30	80	80½	
Penn. Glass Sand Corp. 6's†	2- 5-30	100½	102	
Penn. Glass Sand pfd.	2- 5-30	100	.....	1.75 qu. Jan. 1
Petoskey P. C.	2-10-30	7½	8¾	15c qu. Dec. 31
Port Stockton Cem. com.[9]	2- 7-30	.....	100	
Riverside Cement com.	2- 7-30	10	16	
Riverside Cement pfd.[9]	2- 7-30	75	82	
Riverside Cement, A[9]	2- 7-30	.....	16	
Riverside Cement, B[9]	2- 7-30	4	.....	
Santa Cruz P.C. 1st 6's, 1945‡	2- 7-30	105¾	.....	6% annually
Santa Cruz P. C. com.	2- 7-30	92	.....	$1 Jan. 1 & $2 ex.
Schumacher Wallboard com.	2- 7-30	12¼	13½	
Schumacher Wallboard pfd.	2- 7-30	21⅝	24½	50c qu. Feb. 15
Southwestern P. C. units[41]	1-23-30	260	.....	
Standard Paving & Mat. (Can.) com.	2-10-30	24½	25	50c qu. Feb. 15
Standard Pav. & Mat. pfd.	2-10-30	.....	89½	1.75 qu. Feb. 15
Superior P. C., A	2- 7-30	40½	44	27½c mo. Mar. 1
Superior P. C., B	2- 7-30	15¼	16½	
Trinity P. C. units[37]	2-10-30	125	135	
Trinity P. C. com.[37]	2-10-30	45	.....	
Trinity P. C. pfd.[29]	1-28-30	102	.....	
U. S. Gypsum com.	2-10-30	49	49¼	40c qu. Dec. 31
U. S. Gypsum pfd.[29]	2- 7-30	121	.....	1¾% qu. Dec. 31
Universal G. & L. com.[3]	2-11-30	No market		
Universal G. & L. pfd.[3]	2-11-30	No market		
Universal G. & L., V.T.C.[3]	2-11-30	No market		
Universal G. &L. 1st 6's[3]	2-11-30	No market		
Warner Co. com.[16]	2- 8-30	38	40	50c qu., 50c ex. Jan. 15
Warner Co. 1st 7% pfd.[16]	2- 8-30	97	99	1¾% qu. Jan. 2
Warner Co. 1st 6's[8]	2-11-30	97	.....	
Whitehall Cem. Mfg. com.[36]	2- 7-30	40	.....	
Whitehall Cem. Mfg. pfd.[36]	2- 7-30	48	.....	
Wisconsin L. & C. 1st 6's[15]	2-11-30	94	.....	
Wolverine P. C. com.	2-10-30	5½	5⅞	15c qu. Feb. 15
Yosemite P. C., A com.[9]	2- 7-30	2¾	3¼	

†$52,000 called for redemption at 105, January 1, 1930. ‡Entire issue called for redemption at 110, March 1, 1930.

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler Beadling & Co., Youngstown, Ohio. [5]Freeman, Smith & Camp Co., San Francisco, Calif. [6]Frederic H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Peters Trust Co., Omaha, Neb. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co., of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simons & Co., Inc., Detroit, Mich. [22]Hemphill, Noyes & Co., New York, N. Y. [23]California Co., Los Angeles, Calif. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Bank of Republic, Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago, Ill. [33]Boettcher Newton & Co., Denver, Colo. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick & Co., Montreal, Quebec. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co., Chicago, Ill.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
Atlantic Gypsum Products Co. 6's, 1941, $4,000 and 40 shs. com.[1]	35%	.....
Atlantic Gypsum Products 6's, 1941, $5,000; 50 shs. com. as bonus[3]	49%	.....
Atlantic Gypsum Prod. Co. pfd., 750 sh.[10]	$10 per share	.....
Consolidated Cem. com. v.t.c., 3220 shs.[1]	1½ per share	.....
Indiana Limestone deb. 7's, 1936, wtih warrants ($1,000)[4]	$500 for the lot	.....
Penn.-Dixie Cement Corp. 6's, Sept. 15, 1941 ($1,000)[5]	71%	.....
Universal Gypsum com. trust ctfs., 800 shs.[2] (no par)	$5 for the lot	.....
Universal Gypsum com., 300 shs.[2] (no par)	$6 for the lot	.....

[1]Price at auction by Wise, Hobbs & Arnold, Boston, Dec. 18, 1929. [2]Price at auction by Adrian H. Muller & Son, New York, Dec. 18, 1929. [3]Price at auction by R. L. Day & Co., Boston, Dec. 18, 1929. [4]Price at auction by Adrian H. Muller & Son, Dec. 26, 1929. [5]Price at auction by Wise, Hobbs & Arnold, Dec. 26, 1929. [10]Price at auction by R. L. Day & Co., Boston, Nov. 6, 1929.

Lawrence Portland Cement Company's Annual Report

THE ANNUAL report of Frank H. Smith, president, Lawrence Portland Cement Co., to the stockholders is a brief outline of the more important developments and plant improvements made in 1929. Mr. Smith's report follows:

No property has been purchased or sold at Northampton, Myerstown or Thomaston. At the Northampton plant the principal improvements include the following:

A "Kleen Heet" oil burning system, including a new boiler and a 15,000 gal. capacity oil tank to provide steam for heating the office building, sub-stations and bag house, two pyrometers to record graphically the temperature of the rotary kilns, a 15,600 gal. capacity steel oil tank in which to store oil used in one of the departments, perforated steel grates over the conveyors in No. 1 and No. 3 stockhouses, an additional 5-in. pipe line through which to pump cement from the mill to distant silos, one jackhammer drill and one B. and D. electric hammer.

In the "Hy-Test" masons' cement department the tests referred to in the last annual report were completed early in 1929 and as a result of these tests a change was made in the process of manufacture of "Hy-Test" cement, which is produced for the Hy-Test Cement Co., which change has proved satisfactory to all concerned.

New Power Rates Effect Savings

The Pennsylvania Power and Light Co., from whom electric current is purchased for the operation of the entire plant, issued a new tariff effective June 1, 1929, and between June 1 and November 30, 1929, purchased current costs 9.036 mills per kwh. as compared with a cost of 10.32 mills per kwh. under the tariff which was put into effect May 16, 1928.

December 1, 1929, the power company made effective a new tariff under which it is estimated the cost of current for 1930 will be slightly under 8 mills per kwh. and in view of this new tariff, consideration of the installation of a waste heat boiler power plant at Siegfried has been postponed for one year, on the belief that by the end of 1930 the power company will be in position to name a rate for current that will justify abandoning plans for the installation of a waste-heat boiler power plant.

As a result of the change-over from 25 cycle to 60 cycle current equipment which became fully effective on June 11, 1927, and subsequent reductions in tariff rates by the Pennsylvania Power and Light Co. for 60 cycle current, the cost of 60 cycle current as compared with the cost of 25 cycle current under the tariff effective early in 1927 has shown a saving of about $120,000 in excess of the cost to us of discarding 25 cycle equipment and the substitution of 60 cycle equipment.

The employe members of the plant fire department have continued to maintain interest in the work of the department and the safety and welfare department has continued operations with satisfactory results as lost-time accidents in 1929 aggregated 72 days as compared with lost-time accidents in 1928 aggregating 182 days.

The Metropolitan Life Insurance Co. group life master policy has been continued and now covers all eligible employes at both plants as well as the employes of your New York, Philadelphia and Boston offices.

Improvements at Thomaston

At the Thomaston cement plant the principal improvements in 1929 include the following:

A 10-ton Plymouth gasoline locomotive, an electric well drill, the conversion of a gasoline motor operated well drill to an electric motor operated well drill for the cement mill quarry, the conversion of the General Excavator machine to make same available for shovel work, a building in the cement mill quarry to house the locomotives, the installation of filters with which to remove a large percentage of the water from the slurry before it is conveyed to the kilns, an addition to the kiln building roof to house the filters, the closing of one end of the kiln building with a gunite wall, a recording pyrometer and a productometer for the coal drier, draft gages and a pyrometer for the rotary kilns of the cement plant, two tachometers for attachment to the coal feeders, one optical pyrometer for use of the kiln operators, the conversion of one clinker grinding compeb mill from a three-compartment mill to a four-compartment mill, the rebuilding and installation of a clinker weighing machine to weigh the clinker produced in the rotary kilns, new screens in the packhouse and the extension of the stockhouse to permit the storage of additional box cars required for the packing department.

The Thomaston plant produced 657,228 bbl. of cement in 1929 as compared with 523,850 bbl. manufactured in 1928 and the shipments during 1929 aggregated 776,627 bbl. as compared with 373,102 bbl. shipped in 1928.

The lime plant on the Thomaston property has been improved by the purchase and installation of a hydrator and necessary equipment to enable the production of three grades of hydrated lime to meet market conditions, induced draft for the two kilns, the removal of the automatic stokers and the substitution of hand-fired furnaces, a conveyor for the transfer of coal from storage to the firing floor of the kilns, the reinforcement of both lime kilns with heavy steel construction, a small office and tool storage room in one end of the lime plant for use of the foreman and a small extension of the sprinkler system in one building of the lime plant which has effected a reduction in the insurance rate of this building.

The welfare and safety first department at Thomaston has continued functioning during 1929 with satisfactory results, as our lost-time accidents during 1929 were materially reduced as compared with the 1928 record, during which year this department was organized.

Additional drilling with core drills and well drills has been done to prove up some of the property immediately adjacent to both quarries that had not been prospected.

The company increased to some extent its investment in the Calcite Quarry Corp. and while this corporation was not able to pay any dividend in 1929 due to the fact that the quarry has not yet been developed to a capacity that will yield the entire requirements of the Calcite corporation, the Lawrence Co. received from this corporation the rental prescribed by the terms of the lease which covers interest on the purchase price of the Myerstown properties and the supply of limestone for Siegfried at cost of production, which was lower than the market price for limestone.

No changes have been made in the finan-

CEMENT AND LIME MANUFACTURED, PURCHASED AND SOLD IN 1929 BY THE LAWRENCE PORTLAND CEMENT CO.

	Manufactured	Purchased	Sold
Portland (bbl.)	2,556,168	6,590	2,774,471
Super Dragon (bbl.)	28,784	.....	37,047
Special Mix (bbl.)	15,159	.....	18,374
Hy-Test (bbl.)	367,273	.....	365,624
Specialties (bbl.)	.....	911	882
Lime (net tons)	14,195	789	13,999

CONDENSED STATEMENT OF INCOME (YEAR ENDED DECEMBER 31, 1929)

Income from sales of cement and lime	$824,738.70
Other income	141,117.10
	$965,855.80
Provision for depreciation, interest, bond discount amortization, bad debts, and federal taxes	489,130.48
Net income carried to surplus account	$476,725.32

CONDENSED BALANCE SHEET AS AT DECEMBER 31, 1929

ASSETS

Land, buildings, plant and equipment	$11,497,883.83
Deduct amount reserved for depreciation	2,333,303.84
	$ 9,164,579.99
Current assets:	
Cash and accounts receivable (less reserves for doubtful accounts	$ 605,160.60
Cement, materials and supplies on hand (cost)	1,338,856.94
	$ 1,944,017.54
Investment assets	$ 222,510.00
Deferred charges (including unamortized bond discount)	114,361.63
Company bonds in treasury (purchased for sinking fund), cost	44,020.75
	$11,489,489.91

LIABILITIES

Current liabilities (accounts payable), excess of current assets over current liabilities, $1,703,375.64)	$ 240,641.90
Funded debt:	
15-year 5½% gold debenture sinking fund bonds, due April 1, 1930	$ 2,000,000.00
Notes payable, due serially beginning November 18, 1930	240,000.00
	$ 2,240,000.00
Capital stock, issued and outstanding	$ 7,500,000.00
Surplus (after deducting estimated federal taxes)	1,508,848.01
	$11,489,489.91

cial structure of the company during the year other than the payment of the $60,000 serial note due in November, 1929.

The first payment of $75,000 to the sinking fund to be provided for the redemption of the company's debenture bonds is due February 15, 1930, and in connection with this payment bonds have been purchased to the par value of $51,000, which, under the terms of the indenture, may be tendered in lieu of cash on account of this sinking fund.

To meet competitive conditions created by several cement companies in Washington, D. C., an interest in the Washington Cement Warehouse Co. has been acquired, which will enable cement shipments in bulk to the warehouse, unloading and storing it in bulk and packing and delivering to trucks of purchasers.

Importations of foreign cement have continued during the year and have resulted in unsatisfactory prices for "Dragon" cement at points along the coast where the foreign cement has been delivered. Systematic efforts have been continued to secure the much needed tariff protection, but without tangible favorable results to date.

The reduction in the market price for cement in August seriously affected the earnings of the company for the latter part of 1929 and while the price was restored late in November, but little benefit from the restored price has been received since that date, but a favorable effect on 1930 operations is expected.

Consolidated Oka to List Stock on Montreal Exchange

PREPARATIONS are under way to make application to list the shares of Consolidated Oka Sand and Gravel Co., Ltd., on the Montreal stock exchange. The capital stock of the company consists of $701,700 7% preferred stock and 21,000 shares of no par value common. There is also a funded debt of $700,000 6½% first mortgage bonds. The company, incorporated in 1928, represents a merger of Oka Sand and Gravel Co. and the Consolidated Sand Co., Ltd., These two concerns, prior to their co-ordination, were in direct competition and elimination of this element has worked favorably for the present company.

The company concluded a satisfactory year of operations on December 31, 1929, and earnings have been running at the rate of $6 a share on the common stock. In view of this and its outlook for the future, it is thought that some disbursement will be made on the common shares during the current year.

Called for Redemption

NEWAGO PORTLAND CEMENT CO. 6½% notes, 1936, in amount of $13,000 were called for redemption at 102, February 1, 1930, at the Michigan Trust Co., Grand Rapids, Mich.

Wolverine Portland Earnings for 1929

NET income of the Wolverine Portland Cement Co. for the year ended December 31, 1929, amounted to $81,809 after all charges including federal taxes. This is equal to 81 cents a share on the outstanding stock and compares with $51,031, or 51 cents a share in the preceding year. Net sales for 1929 were $841,781 as against $881,446 in 1928.

The balance sheet as of December 31, 1929, and a condensed operating statement are given below:

WOLVERINE PORTLAND CEMENT CO.
CONDENSED BALANCE SHEET, DECEMBER 31, 1929

ASSETS

Current assets		
Cash on hand and in banks		$ 282,699.13
U. S. Treasury certificates		20,000.00
Marketable investments (at cost)		48,387.50
Notes and accounts receivable		37,239.88
Inventories		269,902.63
Total currents assets		$ 658,229.14
Fixed assets		
Land, clay and marl deposits	$ 159,926.34	
Less reserve for depletion	80,811.05	$ 79,115.29
Plant and equipment	$1,323,966.82	
Less reserve for depreciation	805,863.30	518,103.52
Total fixed assets		$ 597,218.81
Deferred and other assets		17,823.58
Total assets		$1,273,271.53

LIABILITIES

Current liabilities	
Accounts and contracts payable	$ 20,486.12
Provision for income taxes	10,172.88
Accrued expenses	4,497.92
Total liabilities	$ 35,156.92
Capital	
Capital stock outstanding	$1,000,000.00
Surplus	198,114.61
Fire insurance reserve	40,000.00
Total liabilities and capital	$1,273,271.53

CONDENSED OPERATING STATEMENT FOR YEAR ENDED DECEMBER 31, 1929

Net sales	$841,780.55
Cost of goods sold (exclusive of depreciation and depletion	623,025.25
Gross profit (exclusive of depreciation and depletion)	$218,755.30
Depreciation	$ 67,211.76
Depletion	7,550.36
Total depreciation and depletion	$ 74,762.12
Gross profit	$143,993.18
Selling expenses	$ 40,290.37
Administrative expenses	23,650.32
Total expenses	$ 63,940.69
Operating profit	$ 80,052.49
Plus non-operating income (net)	11,929.66
	$ 91,982.15
Less provision for income tax	10,172.88
Net profit for year	$ 81,809.27

SURPLUS ACCOUNT

Balance January 1, 1929	$174,832.32
Plus net profit for year as shown above	$ 81,809.27
Adjustment for prior year's depreciation	1,835.00
	$ 83,644.27
	$258,476.59
Less cash dividends paid	$ 60,000.00
Additional income tax paid for 1926	361.98
	$ 60,361.98
Balance December 31, 1929	$198,114.61

Atlantic Gypsum Products Co. Merger Assured

OVER 90% of stock of the Atlantic Gypsum Products Co., Penn Metal Co. and Craftex Co. has been deposited under plan for the unification of the properties of these companies through the Building Products, Inc., a new holding company, organized under laws of Delaware, with 50,000 shares of $100 par 7% preferred stock (cumulative from December 1, 1929, and callable at $105 a share) and 750,000 shares of common stock.

Under the plan, the 20,500 preferred shares of Atlantic Gypsum Products Co. will be exchangeable for common stock of the Atlantic company on basis of 10 common shares for each preferred share, thereby increasing the Atlantic company's common to 455,646 shares. The latter shares will then be exchangeable for common stock of the new holding company on a share for share basis. The $760,000 unsecured floating debt of Atlantic Gypsum Products Co. will be exchanged for preferred stock of Building Products, Inc., par for par. The 16,945 common shares of Craftex Co. will be exchangeable share for share for common stock of the holding company. Preferred stock of Penn Metal Co. will be exchangeable share for share for preferred stock of Building Products, Inc., and 55,141 shares of the latter company's common stock will be issued in exchange for 3,305 common shares of Penn Metal. State Street Trust Co., Boston, is depositary under the plan.

The Atlantic Gypsum Products Co. operates plants in New York City and Portsmouth, N. H., and gypsum quarries in Nova Scotia. The home office is in Boston, Mass.

Giant Portland Earnings

GIANT Portland Cement Co. reports for the year ended December 31, 1929, net income of $84,261, after depreciation, interest, federal taxes, loss on dismantled machinery, etc., equivalent to $2.26 a share (par $50) on 37,233 shares of 7% preferred stock. This compares net income in previous year of $174,870, equal, after 7% preferred dividend requirements, to $1.98 a share (par $50) on 22,085 shares of common stock.—*Wall Street Journal.*

Recent Dividends Announced

Consol. S. & G. pfd. (qu.)	$1.75	Feb. 15
Consumers Co. pfd. (s.-a.)	$3.50	Feb. 20
Consumers Co. pr. pfd. (qu.)	$1.50	Apr. 1
Material Service Corp. (qu.)	50c	Mar. 1
Missouri P. C. (qu.)	50c	Feb. 1
Oregon P. C. com	50c	Nov. 15
Pac. Lime Co. Ltd. pfd. (qu.)	$1.75	Jan. 1
Schumacher Wallboard pfd. (qu.)	50c	Feb. 15
Standard Pav. & Mat. pfd. (qu.)	$1.75	Feb. 15
Superior P. C. Cl. A (mo.)	27½c	Mar. 1
Wolverine P. C. (qu.)	15c	Feb. 15

Foreign Abstracts and Patent Review

Rapid Determination of Lime in Cements. Rogozinski describes an operating control method for the quick determination of the lime contents of portland cement. The cement is first screened over a 254-mesh sieve, then 0.65 gram of screened cement is mixed with 5 cu. cm. of water in a 400 cc. beaker. The beaker is tilted and while stirring 20 cc. of *N*/1 HCl is added. Other weights of cement may be used, but too great a quantity must be avoided, for the transition point at the end of the reaction is not sufficiently sensitive. In order to accelerate the dissolving of the cement, excess of HCl up to 40 cc. may be used. But before dilution with boiling water 20 cc. of *N*/1 NaOH must be added from a pipette.

Stirring is continued until no cement particles can be seen. The beaker is then covered with a watch glass, allowed to remain for 15 minutes in a moderate heat and the solution is then diluted to 200 cc. with boiling water. It is then boiled for 1 minute, a few drops of phenolphthalein solution added and then the hot solution titrated at once with *N*/2 NaOH solution until just before the end point. Approximately normal and normal solutions of the reagents may be used.

From this point, addition of NaOH is made cautiously and with agitation and the precipitate deposited. After precipitation, a filter paper is placed back of the beaker and the coloration of the lower part of the paper (that back of the layer of liquid) compared with the coloration of the upper part. When the lower part of the paper starts to assume a distinctly noticeable rose color, the burette reading of the NaOH is taken. If the rose color is faintly indicated, add another two drops of NaOH and take the average of both burette readings. For more accurate results, repeat on another sample and take the average of the results of both tests for figuring the CaO content.

The lime content is figured in the following manner: Assuming that 0.65 gram of cement, the lime content of which has been determined by analysis, requires 18 cc. of NaOH for titration. Then by the test method of above, treat 0.6652 g., 0.6348 g., 0.6196 g. of the same cement, that is, quantities which differ in their lime content by 0.01 g., 0.02 g., etc., corresponding to 1%, 2%, etc., of CaO. These require for titration 9.3, 10.7, 11.4 cc. of NaOH, respectively. A difference of 1% in lime content of the cement corresponds therefore to 0.7 cc. of NaOH, or 0.1% CaO to 0.07 cc. of NaOH. In this manner a table can be prepared from which can be read directly the lime content of the tested cement. If, for example, 10.35 cc. of NaOH are required for the titration of the cement, then the lime content of the cement is 65.5%. After a little practice the lime content of a cement can be determined easily to an accuracy of 0.1% CaO, as has been shown in testing several portland cements from various cement plants.—*Zement* (1929), **18**, 51.

Effects of Storage on Strength of Fine Ground Cement. Nicolaesco investigated the relation between the fineness in grinding and the retrogression in strengths of portland cements. He found that the retrograding cement leaves a great deal more residue on the 900- and 4900-mesh screens than when examined immediately after grinding. There has been found to be a correlation between the fineness in grinding and the retrogression in the strength of the cement. After having been stored for several months in damp air, the cement showed much more residue on the screens than the fresh cement. The conclusions arrived at in studying this phenomena are: (1) The quality of the cement stored under protection from damp air (in a hermetically sealed bottle or in a bin protected absolutely from damp air) is not affected after a long period of storage. Likewise its fineness in grinding is not affected. (2) Cement exposed to the action of damp air (in bin or sack) suffers a loss in strength. (3) The fineness of the cement is diminished by the retrogression of the strength. (4) The finer the cement is ground, the greater is the action of moisture and the more considerable is the diminution of the quality of the cement.

The test data show therefore that the diminution of the fineness and the retrogression of the strengths are much greater in the cement of maximum fineness in grinding than for the cement of normal fineness. The final conclusion is that good storage has a decided influence upon the quality of the cement, especially cement of great fineness should always be conserved in bins impermeable to damp air and protected from all traces of moisture.—*Revue des Materiaux de Construction et de Travaux Publics* (1929), 242, pp. 401-402.

EFFECT OF TYPE OF STORAGE ON CEMENTS

Cement		Residue on screens 900 mesh	Residue on screens 4900 mesh	Tensile strength, kg./cm.², after 7 days (6 days in air), 1:3 mortar
A	Normal fineness, tested in fresh state	0.1	11.0	27.20
B	Same cement, protected from damp air after 4 months	0.1	11.0	27.00
C	Same cement, after 4 months in concrete bin exposed to damp air	0.2	19.0	24.60
D	Very finely ground cement, tested under identical conditions	....	5.0	28.47
E	as under cements A, B and C.)	....	5.0	28.65
F		0.1	11.0	24.0

Cooler for Rotary Cement Kilns. In discussing his invention, the inventor states that it has been impossible until now to completely cool the clinker discharging from the rotary kiln into the cooling drum, and at the same time preheat fully the combustion air in passing through this drum. This was due to the fact that the combustion air introduced axially could be preheated only at the surface of the hot clinker passing through the drum. The combination air could not penetrate into the hot clinker so as to effect higher preheating of the air and better cooling of the clinker.

The present invention claims to solve the problem by the introduction of the cooling air preferably at that point in the drum, where the clinker accumulates while the drum is rotating. This is effected by designing the cooling drum wall like a grate. This grate-like cylinder is enclosed by a stationary casing provided with a funnel-shaped addition, or extension, which is used for introducing the necessary combustion air. In addition, the funnel is provided with suitable regulating apparatus. Besides assuring better admittance of air to the hot clinker, the gate-like drum wall permits the clinker dust to drop through to the stationary drum to be discharged by conveyors, so that it is not carried with the air into the kiln. The grate surface is suitably designed of grate bar carriers located parallel to the drum axis, in which the grate bars are inserted from the side.—*German Patent No.* 484,322.

Geological Analysis of a French Quarry. Deforge presents a detailed study of the geological structure of the Quarries de Couzon au Mont-D'Or near Lyon, France. The various deposits are analyzed chemically and the alumina content and the hydraulic index of the various strata specimens determined. Vicat's table for the classification of limes and cements is employed—*Revue des Mater. de Constr. et de Trav. Pub.* (1929), 241.

Swiss Cement Industry. The production and sale of cement in Switzerland is covered in a 60-page booklet published by the price investigating committee of the Federal Department of Public Economy (Switzerland) and is available at 3 fr. plus postage.

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux Week ended		Sand, Stone and Gravel Week ended	
District	Jan. 11	Jan. 18	Jan. 11	Jan. 18
Eastern	1,622	1,762	1,534	1,571
Allegheny	2,116	2,103	2,071	2,004
Pocahontas	242	202	539	493
Southern	500	605	6,678	5,597
Northwestern	387	380	853	589
Central Western	397	409	3,534	2,641
Southwestern	316	255	3,253	2,293
Total	5,580	5,716	18,462	15,188

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1929 AND 1930

	Limestone Flux Period to date		Sand, Stone and Gravel Period to date	
	1929	1930	1929	1930
District	Jan. 19	Jan. 18	Jan. 19	Jan. 18
Eastern	5,856	5,048	5,010	4,710
Allegheny	7,735	6,154	5,331	6,415
Pocahontas	278	592	860	1,428
Southern	1,303	1,533	18,738	16,708
Northwestern	1,453	1,020	1,830	2,488
Central Western	1,233	1,164	13,922	11,548
Southwestern	1,159	871	12,479	9,537
Total	19,017	16,382	58,170	52,834

COMPARATIVE TOTAL LOADINGS, 1929 AND 1930

	1929	1930
Limestone flux	*19,017*	*16,382*
Sand, stone, gravel	*58,170*	*52,834*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning February 8:

CENTRAL FREIGHT ASSOCIATION DOCKET

23823. To establish on **sand and gravel**, carloads (See Note 3), from Wapakoneta, O., to Napoleon, O., rate of 90c per net ton. Present rate, 13½c.

23824. To establish on **gravel and sand**, carloads (See Note 3), from Circleville, O., to Johnsons, O., rate of 65c per net ton. Present rate, 70c per net ton.

23825. To establish on **sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica**, carloads (See Note 3), from Huron and Milan, O., to Point Pleasant, W. Va., rate of 227c per net ton. Present rate, 239c per net ton.

23829. To establish on **crushed stone**, carloads (See Note 3), from Milltown, Ind., to Sellersburg and Jeffersonville, Ind., rate of 85c per net ton. Present rate, 114c and 94c per net ton respectively.

23833. To establish on **sand and gravel**, carloads (See Note 3), from Columbus, O., to Solon, O., rate of $1.35 per net ton. Route: C. C. C. & St.L. Ry., Cleveland, O., and W. & L. E. Ry. Present rate, 18½c.

23918. To establish on **sand and gravel**, carloads (See Note 3), from Winona Lake (Warsaw), Ind., to Disko, Ind., rate of 75c per net ton. Present rate, 80c per net ton per Winona R. R. Tariff I. R. C. No. 6.

23919. To establish on **stone, crushed**, in bulk in open top cars, carloads (See Note 3), from Carey, O., to Byesville and Pleasant City, O., rate of $1.35; to Caldwell, O., $1.45, and to Marietta, O., $1.55 per net ton. Present rate: No commodity rates provided from Carey, O., to the destinations involved, classification basis applying, viz., sixth class.

23924. To establish on **sand, gravel, chert, slag, crushed stone, rubble stone and broken stone**, in straight or mixed carloads (See Note 1), except when cars are loaded to full visible capacity actual weight shall govern, from Henderson, Ky., to points in Indiana and Illinois, rates as shown in Exhibit A attached. Present rates, as shown in exhibit A attached. Route—Via L. & N. R. R.

EXHIBIT A

From Henderson, Ky., to St. Louis Division Stations (Representative)
(Per ton of 2000 lb.)

	Miles	†Pres. rate	Prop. rate (17517 scale)
*Evansville, Ind.	....	.....	....
St. Philip, Ind.	18	110	55
Welborn, Ind.	36	125	70
Trumbull, Ill.	52	140	80
Enfiled, Ill.	27	141	80
Dalgren, Ill.	80	167	90
Woodlawn, Ill.	102	178	110
Addieville, Ill.	128	190	120
Okawville, Ill.	132	190	120
Rentchler, Ill.	151	200	130

*Rate published in Glenn's Sand and Gravel Tariff I. C. C. A655 of 55c.

†Present rates applies only on sand and gravel.

23927. To establish on **sand, lake and beach**, carloads (See Note 3), from Grand Haven and Muskegon, Mich., and also from Benton Harbor, St. Joseph, Bridgman, Oakhall, Sawyer, Mich., and Michigan City, Ind., to Ironton, Jackson and Portsmouth, O., rate of **$2.90 per net ton. Present** rate, $3.15 per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

23949. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), to Sharon, Penn., via New York Central direct, rates as shown below.

From	Prop.	Pres.
Jamestown, Penn.	70	80
Hadley, Penn.	70	90

(B) To cancel rates as follows:

	From	
To	Jamestown	Hadley
Brookfield, O.	80	90
Coalburg, O.	80	90
Dorset, O.	....	90
Doughton, O.	80	90
Farrell, Penn.	....	90
Hubbard, O.	80	90
Kinsman, O.	....	90
Latimer, O.	....	90
Wick, O.	90	....

Proposed rate, 70c, under intermediate clause, to Sharon, Penn., per Item (A).

23950. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), from Vincennes, Ind., to Switz City, Ind., rate of 70c per net ton. Present rate, 76c per net ton.

23951. To cancel rates on **stone, crushed**, in bulk, in open top cars, carloads, from Tiffin, O., to all destinations to which rates are now published, classification basis or rates which may be arrived at under origin intermediate application, to apply in lieu thereof.

23953. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica) **and gravel**, carloads (See Note 3), from Winona Lake, Ind., to Academie, Carroll's Crossing and Huntertown, Ind., rate of 85c per net ton. Present rates, classification basis.

TRUNK LINE ASSOCIATION DOCKET

22771. **Gravel and sand**, other than blast, core, engine, fire, foundry, **glass**, molding or silica, carloads (See Note 2), from Reitz Colliery No. 2 and Cairnbrook, Penn., to Johnstown, Penn., 80c per net ton. Present rate, 90c per net ton. Reason—Proposed rate is comparable with rates from Millwood, Derry, Hunker, Yukon, Penn., etc., to Johnstown, Penn.

22560. **Ground limestone**, carloads, minimum weight 50,000 lb., from Union Bridge, Pinola, Cavetown and Charlton, Md., to N. Y. N. H. & H. R. R. points on basis ½c under present lime rates.

22791. **Quartz** (silica rock), carloads, **minimum** weight 40,000 lb., from Bedford Hills, N. Y., to C. F. A. territory, 60% to 120% points. Rates ranging from 22½c to 41½c per 100 lb. **Reason**—Proposed rates are same as now published on feldspar from Bedford Hills to same points.

22805. **Sand**, other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads, **and/or gravel**, carloads (See Note 2), from Carpenterville, N. J., to Palmerton, Penn., **$1.15 per** net ton (present rate, $1.25 per net ton). Reason—Proposed rate is comparable with rates from Carpenterville, N. J., to Bound Brook, N. J., and Andreas, Penn.; also from Morrisville, Penn., to Newark, N. J.

22827. **Ganister rock**, carloads (See Note 2), from Berkeley Springs, W. Va., to Springfield, Brightwood and Chicopee, Mass., 21½c per 100 lb. (Present rate, 30½c per 100 lb., sixth class.) Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

22845. **Building sand and gravel**, open-top equipment, carloads (See Note 2), from Pinewald, N. J., to Matawan, N. J., 70c; Freneau, N. J., 80c, and Morganville to Freehold, N. J., inclusive, 90c per net ton. Reason—Proposed rates are comparable with rates on like commodities from and to points in the same general territory.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

18777. **Stone, broken or crushed, in gondola** or other open cars (See Note 3), from Plainville (Cooks Quarry) and Branford (Pine Orchard Quarry), Conn., to Brewster, N. Y. Present—$1.05 per net ton. Proposed—90c per net ton. Reason—To meet water and truck competition.

18937. To cancel commodity rate of 22½c on **sand, molding**, from Brookview, Niverville and Van Hoesen, N. Y., to Quebec Central Ry. and St. Johnsbury and Lake Champlain R. R. stations, as published in Items 295 and 300 of B. & A. R. R., I. C. C. No. 9067, and apply in lieu thereof sixth class rates as named in B. & M. R. R., I. C. C. A-2162. Reason—To cancel obsolete commodity rates.

SOUTHERN FREIGHT ASSOCIATION DOCKET

48930. **Limestone**, from Ladds and Portland, Ga., to points in Alabama on St. L.-S. F. Ry., C. of Ga. Ry., M. & O. R. R., Southern Ry., N. A. Ry. and A. G. S. R. R. Combination rates now apply and it is proposed to establish commodity rates on **limestone, ground or pulverized** (See Note 1), except when cars are loaded to their visible capacity actual weight will govern, from Ladds and Portland, Ga., to destinations in Alabama on the above mentioned lines, made in line with rates published to numerous other points in southern territory. Proposed rates to representative destinations are:

	From	
To	Ladds, Ga.	Portland, Ga.
St. L.-S. F. Ry.		
Bessie, Ala.	176	176
Townley, Ala.	185	180
C. of Ga. Ry.		
Acmar, Ala.	180	176
Margaret, Ala.	180	176
M. & O. Ry.		
Moffats Spur, Ala.	189	185
Southern Ry.		
Corona, Ala.	185	180
Parrish, Ala.	185	180
No. Ala. Ry.		
Bankhead, Ala.	185	180
A. G. S. R. R.		
Tuscaloosa, Ala.	185	180

Rates in cents per net ton.

48978. **Sand**, from Crossley, Fla., to Matawan, N. J. Present rate, 978c per net ton (combination). Proposed rate on sand (See Note 3) from Crossley, Fla., to Matawan, N. J., 730c per net ton, made in line with rate in effect to Trenton, N. J.

40091. **Stone or slate, crushed,** from Bolivar, Fairmount, Ga., and Tellico Plains, Tenn., to South Bend and Logansport, Ind. It is proposed to establish the following reduced rates on stone or slate, crushed, carloads (See Note 3), to South Bend and Logansport, Ind.: From Bolivar and Fairmount, Ga., 423c; from Tellico Plains, Tenn., 405c per net ton. Same as rates to Chicago, Ill. Note: This proposition was originally docketed for public hearing June 4, 1928 (Docket No. 420) and subsequently withdrawn. The proposition is now reinstated for further consideration.

WESTERN TRUNK LINE DOCKET

6216C. **Limestone, agricultural,** minimum weight 60,000 lb., from Dubuque, Ia., to C. G. W. R. R. stations in Minnesota over 200 miles distant from Dubuque to and including 230 miles. Present—Class rates. Proposed—220 miles, $1.50 per ton of 2,000 lb.—230 miles $1.60 per ton of 2,000 lb.

2079-N. **Stone, rubble (rough, broken, irregular pieces,** not machined or tooled) (See Note 2), but not less than 40,000 lb., from Lannon, Wis., to Corning, Ia., also stations taking Kansas City, St. Joseph, Omaha and Sioux City rates, as shown under third column of the second block of Item 4280C of W. T. L. 1R. Present rates, Class E, 23c to Corning and 24c to other points, per C. B. & Q. G. F. O. 5500J and C. M. St. P. & P. G. F. D. 10000F; proposed, 13½c per 100 lb.

2556M. **Sand,** carloads, from Browntown, Wis., to Duluth, Minn., and Superior, Wis. Present rate, $3.20 per net ton of 2000 lb.; proposed, $2.50 per net ton of 2000 lb.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5445. To amend various items applying in I.F.A. territory on **sand** to correct description applicable to low grade sand which is improper, as follows:

Present—Sand, other than bank, glass, molding, silica, blast, core, engine, filtering, fire or furnace, foundry, grinding or polishing or loam sand.

Proposed—Sand, other than glass, molding, silica, blast, filtering, fire or furnace, polishing or loam sand.

5453. **Sand and gravel,** carloads, from Joliet, Ill., to Illinois, Kankakee, Ill., and Schneider, Ind. Present, combination; proposed, 88c.

Sand, Gravel and Crushed Stone Rates to and in Illinois

WITH sharp division among its members on procedure, the Interstate Commerce Commission, in No. 21939, sand, gravel and crushed stone from Indiana and Illinois points to destinations in Illinois, opinion No. 15311, 160 I. C. C. 507-62, has ordered new rates, state and interstate, to be established on the commodities mentioned and related articles, not later than March 31, into and in southern Illinois.

The rates prescribed are those agreed upon by a committee appointed as a result of conferences held before the formal hearings were begun with a view to disposing of the issues without formal hearing.

This report also embraces I. and S. No. 3093, sand, gravel and crushed stone from Indiana points to destinations in Illinois; and No. 21372, Ohio and Indiana Stone Co. et al. vs. Big Four et al. The findings, as summarized in the head notes, follow:

1. Proceedings in No. 21939 and Investigation and Suspension Docket No. 3093 discontinued in so far as they bring in issue rates on sand, gravel, and crushed stone to destinations in Illinois on the Toledo, Peoria and Western.

2. Rates to destinations in Illinois on and south of the Terre Haute-St. Louis line of the Pennsylvania Railroad on sand, gravel and crushed stone, in carloads, from producing points in Indiana and Illinois, on crushed stone, in carloads, from Marquette and Cape Girardeau, Mo., and on chat, in carloads, from producing points in Missouri, prescribed or approved as reasonable and nonprejudicial for interstate application and nonprejudicial and nondiscriminatory as between shippers in intrastate and interstate commerce.

3. Where proposals as to rates for the future are arrived at as a result of a series of conferences between the parties during the course of the hearings, objection of opposing party to the consideration of such proposals by the commission overruled.

The case was submitted to the commission November 19 and concerned the Ohio and Indiana Stone Co. and Midwest Crushed Stone Co. vs. the Cleveland, Cincinnati, Chicago and St. Louis Railway Co., Chicago and Eastern Illinois Railway Co., Chicago, Burlington and Quincy Railroad Co., Illinois Central Railroad Co. and the Pennsylvania Railroad Co.

South Dakota Cement Rates Discussed

THE question of the validity and lawfulness of present rates in carload shipments of cement from Rapid City, S. D., to intrastate points in South Dakota was recently argued at a joint hearing which was held at the federal building, Sioux Falls, S. D., before W. A. Disque, interstate commerce commission examiner of Washington, D. C., and the board of railroad commissioners of South Dakota.

Representatives from numerous sections of the United States were in attendance at the hearing, most of them representing cement industries and coming to present objections to the present rates on cement shipments, which it is claimed are prejudicial to interstate commerce.

The present basis of cement rates from Rapid City was established, after formal hearing by the board of railroad commissioners, at time of construction of the state cement plant, and was designed "to accord the Rapid City plant an adjustment into the eastern portion of South Dakota at reasonable rates." It was established on a basis which the board considered reasonable compared with existing rates from competing mills in Iowa, Kansas, Illinois and Nebraska.

"The interstate commerce commission had previously prescribed a maximum basis of interstate cement rates for application throughout the so-called 'W. T. L.' territory," the board explained today. "It had, however, prescribed certain bases lower than the maximum scale from other cement mills located in Kansas, Oklahoma and Nebraska."

The pending complaints, filed by cement companies with plants at Mason City, Des Moines, Valley Junction and Linwood, Iowa, allege that present intra-state rates from Rapid City to South Dakota points are unduly preferential to the state plant and unduly prejudicial against the complaining Iowa points. It is claimed the Rapid City rates are lower than the maximum interstate cement rate scales. Eastern South Dakota destinations are said to be the principal markets for cement in this state.—*Sioux Falls* (S. D.) *Argus-Leader.*

Protest Rate Increases in Mississippi Valley Territory

A RESOLUTION adopted by the mayor and board of commissioners of Memphis, Tenn., protesting against proposed increases in rates on sand, gravel, slag, stone and chert in Mississippi Valley territory, has been presented to the Senate by Senator McKellar of Tennessee.

It is asserted in the resolution that the President of the United States has requested the governments of the various states, counties and municipalities to carry on all necessary public works and that the state of Tennessee and various political subdivisions thereof have acquiesced in this request. It is then asserted that the railroads are seeking increased rates on materials used in the building of roads and public buildings.

Senator McKellar continued his campaign against the proposed increased rates on sand and gravel and other road-building materials in the Mississippi Valley by inserting in the *Congressional Record* of January 11 a resolution of the Obion county court of Obion county, Tenn., protesting against the proposed increases, addressed to the commission. In calling the matter to the attention of the Senate, the senator said:

Senator McKellar obtained first-page position in the *Congressional Record* of January 13 with another protest against the proposed increased rates. He submitted a resolution of the Gibson county court in Tennessee protesting against the proposals. This resolution called on the members of the Tennessee delegation in Congress to appear before the commission, "if such be permissible, to protest against such increase in rates or take such other steps as may be necessary and advisable to prevent increase."

"These protests are coming in rapidly and show the determination of the people to resist the increase," commented Senator McKellar. "I want to express publicly the hope that the railroads interested will withdraw their petition to increase rates on road-building materials in the territory involved."

The senator said the railroads were doing so well that they should not seek to inflict a tax of such large proportions on the people of the territory in question.—*Traffic World.*

Lower Rates from Salona, Penn.

THE Bellefonte Lime Co., operating the stone quarry at Salona, Penn., has obtained a favorable decision on a protest which was filed against the freight rates charged to the company by the New York Central, Pennsylvania and Reading and the Buffalo, Rochester and Pittsburgh railroads.

The Public Service Commission granted the so-called Lycoming schedule to the lime company, making a material reduction in the freight rates to various points on the above railroads.—*Williamsport* (Penn.) *Gazette.*

Oklahoma Awards Contracts for 800,000 Bbl. of Cement

THE Oklahoma state commission awarded a contract for 200,000 bbl. of cement each to the Dewey Portland Cement Co., Dewey, Okla.; Oklahoma Portland Cement Co., Ada.; Monarch Cement Co., Humboldt, Kan., and the Universal-Atlas Cement Co., Kansas City, Mo. All bids were the same with the price around $2 a bbl. depending on destination.

These awards were made after frequent conferences with different cement companies with a view towards obtaining lower prices. Lew H. Wentz, chairman of the state highway commission, commenting on the bidding, gave out the following details which are taken from the *Tulsa* (Okla.) *World*:

"The cement mill at Bonner Springs, Kan., offered us cement at prices based on a net at the mill of from $1.21 to $1.26 maximum a barrel. Southern Kansas mills quoted us a price of $1.35 and less at plants in southern Kansas. The Oklahoma plants at Ada and Dewey made an arbitrary price of $1.70 a barrel f.o.b. mill at each point. We asked the Oklahoma mills to quote us a reasonable price at mill points so that we might designate destination points convenient to their plants and thus save freight on short hauls. This would have permitted us to allocate our business in such a way as to save a great sum in freight and we asked that this saving inure to the benefit of both parties.

"The Oklahoma plants refused to consider this plan and insisted on taking advantage of the longer hauls from Kansas points and fixed prices by adding the difference in freight from Kansas mill points. We know this is the cement mnaufacturers' custom, but even custom should not prevent the state benefitting by short hauls on business created by the state.

"As an example, the freight from Ada to Durant is 40 cents per bbl. The price quoted by the Ada plant for delivery at Durant was $1.99 leaving a net at the Ada mill of $1.59. The Bonner Springs mill net on the same shipment was $1.21, a difference of 38 cents a bbl. The Ada plant insisted this difference becomes its profit and compelled its position by force of Oklahoma law."

"The Oklahoma statute giving preference to home industries when used by the cement firms becomes a disadvantage," Mr. Wentz said. "The law provides that when the price and quality are equal, preference must be given Oklahoma plants, allowing them to be assured whatever parts of the business they desire, providing cement manufacturers at other points will all quote the same delivered prices which they did at this bidding."

None of the companies asked to bid on the contracts offered to take the entire amount and the Tulsa *World* of a later date defends their position, stating in part:

"There is no doubt but what there will be an increase in cement prices. If the Dewey plant, for example, had agreed to take the entire 800,000 bbl. at a slight discount from the present market price and suppose its entire capacity is 1,500,000 bbl. annually, it would have had to drop half of its customers and sell the other half at prices higher than they gave the state. It would mean trouble between the company and its remaining customers and chances are the old customers who could not be supplied would never come back. So there is something to be said for the Oklahoma companies which refused to take all the cement the state wanted to buy at a price which is sure to prove lower than what the price will be this summer. Already it had advanced 25 cents a barrel in the Mason City district and 20 cents a barrel in the Minnesota district.

"The so-called gas belt district, which includes this state and southern Kansas, already is off the market and has been for six months. The cement companies could not in justice to their customers bid way down in the face of a coming price boost."

Iron City Sand Adding to Capacity

THE Iron City Sand and Gravel Co., Pittsburgh, Penn., operating extensively along this section of the Ohio river, is making plans to considerably increase its capacity.

Five new barges for the company are being built at the plant of Ritter Conley, Leetsdale; a contract has been let for five more to the Dravo Contracting Co., and its sand dredge, *Elizabeth Pheil*, is being overhauled at the ways of the American Bridge Co. A crusher and increased engine capacity is being installed in the dredge.—*Ambridge* (Penn.) *Citizen.*

Bluffton Stone Company Organized

ANNOUNCEMENT is made of the formation of the Bluffton Stone Co., a $50,000 corporation, at Bluffton, Ohio. Incorporators of the company include Raymond Conrad, Clair B. Fett, Gilbert Fett and Alfred Mueller. The concern will be financed by local capital.

Decision to organize a new stone company came when the National Lime and Stone Co. decided to abandon the Bluffton quarry when its main building was destroyed by fire with a loss of $200,000 late in 1929. Mr. Conrad was for years office manager of the National company when it operated at Bluffton.

Options on locations are reported to be held by the company and it is understood that the decision is pending between two sites, both of which are located on railroads. Building operations will be started the first of March, it is said, with production of stone from the new quarry scheduled to start late in June.—*Bluffton* (Ohio) *News.*

New Gravel Firm Puzzles Port Jefferson

AMOST extraordinary development has appeared in "to dig or not to dig gravel" controversy in Port Jefferson, Long Island, N. Y. The Curran properties, owned (formerly and possibly now) by P. A. Curran, have been posted with signs stating that they have been taken over by the Freel Sand and Gravel Corp. And the puzzling part of the situation is that Mr. Curran has been one of the bitterest opponents of the sand and gravel operations at Belle Terre. It is said that he paid $10,000 to oppose the Seaboard Sand and Gravel Corp. when it started operations here, and now apparently he is in the business himself.

Mrs. Curran is the daughter of the late James Freel, a prominent politician, and it is presumed that her maiden name is being used in the new company, but no one seems to find any assistance in that toward an understanding of what it is all about. Curran has lately added a 40-acre tract adjoining his Belle Terre holdings and another 40-acre tract acquired by J. P. McAllister leads some to believe that he is also in on the new company.

Restrictions of Belle Terre expired on January 1, 1930.—*Patchogue* (N. Y.) *Argus.*

Industrial Silica Corporation Increases Production

PRODUCTION for Industrial Silica Corp., Youngstown, Ohio, in the first nine months of its operation in 1929 was 25% higher than for individual units in 15 plants, merged to form the corporation, in the same period in 1928.

More than 500,000 tons of silica sand were produced and profit was earned to meet interest on $1,000,000 of 6% bonds and dividend requirements on $1,375,000 of 6½% preferred stock. The company is the largest producer in the country of silica sands for steel foundries, water works and other industries. There are 100,000 shares of common stock outstanding.—*Wall Street Journal.*

Northern Gravel Improving Barton Plant

NORTHERN GRAVEL CO., Barton, Wis., has been making extensive improvements at its sand and gravel plant under the direction of Frank Bingham, superintendent. A combined workshop and storage building is being erected. The old boiler house is being torn down, as it is no more needed since the entire plant is operated electrically. In its place a 25x88-ft. new building is being erected, 32 ft. of the length to be used for a modern work and repair shop, the balance, 56 ft., to be used as a garage and storage room.—*West Bend* (Wis.) *News.*

Sand-Lime Brick Production and Shipments in January

THE following data are compiled from reports received direct from 17 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is seven less than those furnishing statistics for the December estimate, published in the January 18 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having about one-half the production capacity in the United States and Canada.

January showed comparatively small activity in the sand-lime brick business with many of the plants closed down entirely. Seven plants reported no production at all, and the production for the whole country was lower than in December, 1929. Although the number of plants reporting is seven less than in December, it is estimated that shipments both by rail and truck decreased from the figures of the previous month, although stocks on hand remain about the same as do unfilled orders.

The following are average prices quoted for sand-lime brick in January:

Shipping Point	Plant Price	Delivered
Boston, Mass.	$12.00	$16.00
Dayton, Ohio	12.50	15.50
Detroit, Mich.	.....	16.00
Detroit, Mich.	13.00	15.50@16.00
Detroit, Mich.	.....	15.50
Gr'd Rapids, Mich.	14.00@15.00	.....
Menominee, Mich.	11.00	13.50
Minneapolis, Minn.	8.00	10.00
Mishawaka, Ind.	11.00	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Can.	11.00	13.00
West Toronto, Can.	.....	13.00
Winchester, Mass.	.....	16.00

The following statistics are compiled from data received from 17 producers in the United States and Canada:

Statistics for December and January

	*December	†January
Production	9,215,000	4,021,000
Shipments (rail)	2,658,000	1,731,000
Shipments (truck)	5,246,000	2,636,000
Stock	13,859,000	9,716,000
Unfilled orders	7,008,000	5,404,000

*Revised to include figures from two plants not included in statistics published January 18. Twenty-four plants reporting; incomplete, one plant not reporting rail and truck shipments, three plants not reporting stocks on hand and eight plants not reporting unfilled orders.

†Seventeen plants reporting; incomplete, one plant not reporting stocks on hand, and five not reporting unfilled orders.

Notes from Producers

Jackson Brick Co., Jackson, Mich., are supplying sand-lime brick for the girls' dormitory at the Ann Arbor University, Ann Arbor, Mich.

British Sand and Gravel Dredging Practice

THE EDITOR: In ROCK PRODUCTS, April 13, 1929, you printed certain excerpts from a paper I wrote on centrifugal pumps and their commercial application in this country. Your major criticism was that I had scarcely mentioned "cutters." I scarcely mentioned these not because I was unaware of their potentialities, but because I was writing of their application to this country. Here their use is so little that it may be classed as negligible for commercial purposes. Rightly or wrongly, I attribute their lack of use to the following causes:

(1) We are geologically less fortunate than the U.S.A. in that our sand and gravel deposits average only 20 ft.

(2) Normally our spoil will pass through the suction of an 8-in. pump, thus discounting the advantages of the traveling chain to remove big stones.

(3) Our labor is cheaper and our capital outlay on plant more extensive per cubic yard excavated than in U.S.A., and therefore we are less disposed to expend capital to lessen labor costs.

(4) Add to No. 3 our unemployment question and our governments, whether Conservative, Liberal or Socialist, none of which permit reasonable allowances for depreciation of plant for income tax purposes.

(5) Most of our gravel is deposited on top of clay deposits. Much of this clay is very soft and when a cutter is applied to the nozzle there is a great risk of cutting this clay and delivering it to the consumer in the form of aggregate, which obviously would be fatal.

(6) The proportion of clay delivered is in proportion as No. 5 remark above is applied to No. 1, i.e., the softer the clay and the less deposit of gravel that lies above it the dirtier will be the aggregate delivered to the consumer.

(7) In most cases of extremely hard gravel we therefore find that it is preferable to loosen this by dragline, a machine obviously able to perform many other duties, rather than by cutter gear. Our shallow mineral deposits render this method practicable.

I read your ROCK PRODUCTS and other periodicals with an envious feeling that the U.S.A. is blessed by having deeper gravel deposits, surface coal deposits, cheaper power in all forms and a greater economical advantage generally than we in this country can hope to find. Nevertheless although mechanically years behind your country, we are rapidly bringing our gravel pits to a state of reasonable efficiency.

R. S. BREWIS.
Tetherdown, England.

Possible Merger in Yonkers

A POSSIBLE consolidation of three of the larger sand and gravel companies in the Yonkers, N. Y., district is reported in the *New Rochelle* (N. Y.) *Standard*. The merger would include the Yonkers Sand and Stone Co., Frank Cooney, Inc., and the F. A. Oatmann and Sons, Inc.

White Rock Silica Plant to Be Enlarged

PLANS now being formulated may make the White Rock Silica Co. plant at Browntown, Wis., one of the largest in the United States, according to J. J. Gault, plant consulting engineer, who is overseeing new construction work. The company's investment in the plant may be increased to $300,000 or more when two units are added to the present three. The capacity of the plant will almost be doubled.

The company will make a pulverized silica to be used as scouring powder, etc., in addition to the usual glass sand. Part of the sand hill at Browntown, which officials thought was worthless, has been found to contain molding sand of a good grade.—*Brodhead* (Wis.) *Register*.

Glencoe Lime and Cement Co. Celebrates Golden Anniversary

FIFTY YEARS ago, the Glencoe Lime and Cement Co., St. Louis, Mo., came into existence as a small producer of lime and dealing of other building materials. Today it is recognized as one of the largest building material dealers in St. Louis, operating seven warehouses and three lime plants. The recently issued annual price list and catalog is indicative of its growth, listing practically every building need.

Duluth Safety School

THE January session of the sixth annual safety school by the Duluth (Minn.) Chamber of Commerce was held on January 8. Although the temperature was many degrees below the zero mark, all of the sessions were jammed to capacity. Over 850 persons attended.

Gordon C. Huth, safety engineer of the Universal Atlas Cement Co. at Duluth, is chairman of the school, which was attended largely by employes of the cement company and other rock products, ore and transportation industries. The principal address at the school, on the subject of "Succeeding with Safety Work," was given by A. J. R. Curtis of the Portland Cement Association.

Salute to the Cement Industry

FRANK H. Smith, president of the Port-Portland Cement Association, will speak during the "Salute to the Cement Industry," February 18, at 10 p. m., eastern standard time. This program, dedicated to the cement industry, is one of a series broadcast by the Westinghouse Electric and Manufacturing Co. through the National Broadcasting Co. and comprises a tribute to one of our newest and most important industries. In addition to the address by Mr. Smith and a talk of the romance of the cement industry there will be presented a fine program of orchestral music and choral singing.

Sand-Lime Brick Association Convention Adopts Promotion Program

New York City Meeting Most Important Ever Held by Industry

THE 26TH ANNUAL CONVENTION of the Sand-Lime Brick Association in New York, February 4 to 6 inclusive, marked the most important step taken by the association since its formation. After many years of consideration and talk and numerous pleas by John L. Jackson, one of its original members, and for a number of years president, and after an earnest plea by T. C. Tayler, chairman of the association's committee on publicity, the association voted practically unanimously to assess the membership 5 c. per thousand brick produced in order to engage in research, advertising and publicity.

New Officers for 1930

Allen G. Walton, Philadelphia, Penn., was re-elected president; A. S. Robertson, Toronto, Ont., vice-president; Ellen Knight, Saginaw, Mich., secretary and assistant treasurer; J. Finkbeiner, Detroit, Mich., treasurer.

The following were elected members of the executive committee: C. H. Carmichael, Boston, Mass., chairman; John L. Jackson, Saginaw, Mich.; Otto Schwartz, New Orleans; W. A. Smyth, Toronto, Ont.; J. G. Schluchter, Detroit, Mich.; R. C. Kiser, Dayton, Ohio, and John Zellie, Minneapolis, Minn.

The members of the educational and simplified practice committee were chosen as follows: Dr. L. S. Wells, U. S. Bureau of Standards, Washington, D. C., chairman; J. A. Murray, Cedar Hollow, Penn.; C. H. Carmichael, Boston, Mass.; W. A. Kennedy, Toronto, Ont.; H. J. Levine, Long Island City, N. Y.; T. C. Tayler, Detroit, Mich., and John L. Jackson, Saginaw, Mich.

The traffic committee was re-elected as follows: J. M. Zander, Saginaw, Mich., chairman; A. K. Walton, Hummelstown, Penn.; W. H. Crume, Dayton, Ohio; R. E. Boomer, Detroit, Mich., and I. G. Toepfer, Milwaukee, Wis.

The two committees on advertising and publicity were combined into one, with the following membership: John L. Jackson, Saginaw, Mich., chairman; I. G. Toepfer, Milwaukee, Wis.; J. Finkbeiner, Detroit, Mich.; T. C. Tayler, Detroit, Mich., and N. C. Rockwood, Chicago, Ill.

Favor Tariff on Brick

President Walton in his brief opening address touched on the high points of the industry during 1929, stating that the association had gone on record before the ways and means committee of the United States House of Representatives in favor of a tariff on brick. He also paid a tribute to J. A. Murray of the United States Bureau of Standards, who is leaving the bureau March 1 to become the head of the research laboratories of the Warner Co. at Cedar Hollow, Penn.

He stated that Dr. L. S. Wells was succeeding Mr. Murray at the Bureau of Standards and would take Mr. Murray's place on some of the committees that Mr. Murray had served.

Discrimination Against Sand-Lime Brick Removed in New Jersey

President Walton also referred to the triumph of sand-lime brick manufacturers in the state of New Jersey, where after strenuous work the discrimination against sand-lime brick by the fire underwriters had been overcome, stating that sand-lime brick is now given exactly the same rating as clay brick, and that the following new members were elected: Iona Brick Co., Clayton, N. J.; Mutual Materials Co., Seattle, Wash.; Standard Lime Co., Montreal, Que.; Watertown Builders Supply Co., Watertown, Mass.; Alsip Brick, Tile and Lumber Co., Winnipeg, Man.; Missouri Hardstone Brick and Tile Co., St. Louis, Mo.; Gray Ferry Brick Co., Philadelphia, Penn.

Properties and Tests of Sand-Lime Brick

J. A. Murray (U. S. Bureau of Standards, Washington, D. C.) gave a brief address on "The Absorption and Strength of Commercial Sand-Lime Brick," largely reviewing and explaining the bureau's tests of sand-lime brick which were published in detail in ROCK PRODUCTS, November 23, 1929, reprints of which were available for the members at the convention. He had prepared, however, a table somewhat different from those published in ROCK PRODUCTS and explained the classifications of the brick in three classes, A, B and C, stating that most manufacturers are making a B grade product which corresponds in all its specifications to common clay brick.

Architects Must Learn More About Sand-Lime Brick

Kenneth K. Stowell (associate editor, *Architectural Forum*, New York City) made a brief but very valuable address on some of the things that an architect does not know about sand-lime brick. In a nutshell, Mr. Stowell said that architects knew practically nothing and that the fault was not entirely the architect's, as there is very little mention of sand-lime brick in architectural literature. He propounded a number of questions that he would like to see answered for the benefit of architects, including the following: Will the use of sand-lime brick save money? Produce effects that cannot now be had in other materials? Produce a lighter wall? A stronger wall? What effect does moisture and frost have on sand-lime brick? In what colors may sand-lime brick be had? How does color affect strength and weathering properties? Where may sand-lime brick be used to the best advantage, for face brick, light courts, backing, etc.? How does it compare for these and other purposes with the other wall materials it competes with? Are sand-lime brick uniform? How can an architect tell good from bad brick? How may an architect write specifications for the right kind of brick? Are sand-lime brick used easily by bricklayers? Have bricklayers practical objections to them, etc.? What should be the mortar specified for use with sand-lime brick? Where can an architect see some in use? Are sand-lime brick readily available, can the contractor get a sufficient and regular supply? Are sand-lime brick made in a variety of shapes and are they standardized? Just what is it that makes sand-lime brick superior to competitive materials?

Educational Campaign Needed

These questions Mr. Stowell said he would like to see answered for the benefit of architects, and stated he could see two major problems before the sand-lime brick industry in regard to the furnishing of information, one relating to technical problems of their manufacture, properties, and the other relating to merchandising; that is, the facilities of dealers and contractors, speculative builders and architects, to obtain a source of supply.

Mr. Stowell's remarks were applauded and commented on very favorably throughout the sessions of the convention and undoubtedly were an important influence in bringing to a head the decision of the members to go into a research and educational campaign.

Sales, Promotion and Possibilities

John R. Kauffman (Crume Brick Co., Dayton, Ohio) discussed "The Use of Testing Machines to Control the Quality of Brick," illustrating his talk with the use of a machine for testing brick in cross bending, developed by the U. S. Bureau of Standards and manufactured by the Morehouse Machine Co., York, Penn. Mr. Kauffman explained how the Crume Brick Co. had a very thorough and complete system of testing samples from their cylinders of brick that was made, not only to provide against the marketing of any brick below standard, but to actually furnish constructive data in regard to the reasons why some brick were stronger and better than others, and the application of the data so obtained in constantly improving the brick.

Use Testing Machine

The testing machine that he used is a portable one and has proved very useful in selling sand-lime brick because it could be taken right to an architect's office and a demonstration of the strength of the brick given in a few moments. Mr. Kauffman said in part:

"The Crume Brick Co. purchased a portable hydraulic flexure testing machine several years ago, but for some time it was used only when visual inspection of the daily run of brick indicated that the product might be different from the average run; or if a change in lime or sand was made, the brick were tested to see that they measured up to what we consider standard quality.

Daily Records Kept

"In August, 1928, we began to use the machine daily, keeping records of the average breaking load. Ordinarily the average breaking load varies only slightly, but if the tests show any considerable decrease or increase over our standard, we immediately check up on the lime, the grade of sand, the steam chart from the cylinder in which they were cured, the water in the boiler, etc., and if the cause is not located at once, we have a chemical analysis made of the raw materials.

"In sampling for tests, from 3 to 6 bricks are taken at random from each cylinder and tested after cooling. The actual testing is simple, as the breaking load is read direct from the gage and entered in the record book; and this is usually done by the shipping clerk in spare time.

Avoids Under-Standard Brick

"Since this system has been used we have avoided the possibility of brick under standard being shipped to our customers. In any case if brick show below average a re-check is made and if this shows the same result, the brick are sent to piles to be used as backing or filler brick. Where brick run very much higher strength than standard we try to analyze the cause, with the purpose of making a brick of higher standard. In fact, some of the results of our research indicate that we will be able to make a better brick than our present standard at no increase in cost and probably at a lower cost than at present.

"We test our concrete or cement brick in the same manner and keep a record as for sand-lime brick.

"Our cement brick are made on the same equipment and hardened by high pressure steam and ready for delivery when removed from the steam cylinders; therefore the testing machine gives the strength of the concrete brick in time to prevent any deliveries of inferior brick.

A Good Sales Argument

"This testing machine has a place in the sales department and we have used it at various times. Usually where some new customer or out-of-town architect is skeptical as to our salesman's claims as to the strength of our brick, we take our machine to his job or office, place our brick in it and ask him to turn the screw, and if he has some competitive brick, test that also. The result of the test verifies our salesman's claim, and there is a psychological effect on the architect or buyer, as the idea is new and novel to him and he will remember for years that the brick tested all right, while he will forget figures submitted to him as to results of tests.

"The machine gives no trouble and is easily handled and taken care of.

"In cases where it seems desirable to change the lime, sand or proportions it is a simple matter to run out a small batch of bricks, steam them and test them before making any change in manufacturing conditions.

"It is not to be understood that we recommend sole reliance on the results obtained with the portable testing machine, for we have our brick tested at intervals at commercial laboratories and also a chemical analysis of lime, sand, etc., but for a daily check of the quality of brick produced we find it invaluable."

Colored Face Brick

R. B. Stuckey (W. A. Riddell Co., Bucyrus, Ohio) read an extremely interesting paper and demonstrated with samples some beautifully colored veneered sand-lime brick. This veneering is made in a special press or a special device that can be applied to any brick press by the Riddell company and provides a sand-lime brick with an integral facing approximately ½ in. thick, using almost any mineral coloring. These samples were broken in the testing machine and showed that the veneering was fully bonded with the rest of the brick.

The materials most used in the samples were granite and marble and ground red clay brick to give the red facing. The facing was a lime mixture with the coloring matter, but in some instances portland cement was added to give additional bond in the facing material.

Mr. Stuckey stated that the brick was the result of several years' experiments and that it had been very difficult to develop the device because the face occurs on the side of the brick as it is pressed in the machine. It is done by a removable plate and separate feed hoppers, or two-compartment feed hopper, automatically controlled by the compressor mechanism, so that exactly the right amounts of facing and backing material are provided for each brick, and as the press revolves the division plate is removed and the pressure applied to the brick. Mr. Stuckey stated that he believed the extra cost of the facing would in practically all instances be less than $10 per thousand.

Probably greater interest was shown in his product and his paper than any other one item on the convention program, and if it proves practicable and feasible to make colored face sand-lime brick, undoubtedly the market for such brick will be very considerable and their cost will be far less than clay face brick, while the artistic effects possibly are unlimited.

The same process may be applied to the manufacture of concrete brick.

Asphalt-Impregnated Brick

G. G. Heghinian (consulting engineer, Baltimore, Md.) read an extremely interesting paper entitled "Possibilities of Sand-Lime Brick," which is reproduced in abstract in what follows:

"In 1904 I became engineer for an asphalt-block manufacturing company in New York City. At the time I entered their employ the company had a press on trial at its plant. This proving unsatisfactory, I had to design a new press along an idea which came to me. This I built and operated. I secured a patent for it in 1906, secured another patent on it in 1915, and have today two applications in the patent office for further improvements on this press.

Factors Affecting Press Design

"As I see it, there are a number of factors entering into a business that uses a press to make its finished product from a loose material. I shall enumerate a few of these factors: (a) *Character of the ingredients;* (b) *Material gradation;* (c) *Size of particles in the gradation;* (d) *Temperature of the mixture;* (e) *Cementing agent, amount and temperature;* (f) *Feeding of the loose*

material to the die box; (g) *Method of applying pressure;* (h) *Amount of final pressure applied;* (i) *Curing—method and duration.*

"(a) *Character of the ingredients used*—It is self-evident that a brick made with a good, clean, sound, sharp sand is far better than one made with a dirty or inferior sand.

Cementing Agents—Characteristics

"(e) *Cementing agent*—The cementing agent, whether it be asphalt, portland cement, lime or glue, in the first place is the most expensive item of the entire aggregate. Therefore, care must be taken to use just enough and no more, nor less. The amount of cementing agent needed is proportional to the total superficial area of the particles to be covered and not to their total weight. In other words, a certain percentage of a cementing agent used by weight will be too much, if it is used with a coarser material, and will not be enough if it is used with a finer material of the same weight.

"A cementing agent mixed with loose material performs two distinct services: (1) It binds the particles of the material together; (2) it fills the voids between the particles. The part of cementing agent used to fill the voids does not give additional advantage in proportion to the increased cost due to its use. In some cases it is even detrimental. Therefore, it is important that the particles of the loose material be graded so that the voids will be reduced to a minimum.

Feeding Methods

"(f) *Feeding the loose material to the die box*—This part of the work on the surface seems so simple and easy; all one has to do is to drop the material into the die box; but when it comes to doing it properly, it is one of the hardest tasks. The quality and uniformity of the finished product depend on this factor more than on any other factor.

"Some manufacturers use gravity feed, some use mechanical force feed and others use a combination of both. In all these methods, the aim is to fill the die box uniformly; so that, when the pressure is applied, the finished product will have a uniform density throughout.

"When the loose material is falling into the die box, it falls more freely at the center than at the sides and the corners, because the friction of the sides retards the fall of the material, and sometimes the loose material arches between the bottom and the sides, resulting in an uneven distribution of material in the die box; consequently, when the pressure is applied one cannot expect anything but unequal density of the finished product. Unfortunately, the parts one wants to be the densest, the edges and the corners, are the poorest.

"Side friction effect retarding the advance of loose material into the die is well illustrated in the clay brick made with an auger type machine. The friction effect is increased by the mechanical force to the extent that it produces lamination in the brick because the movement of wet clay at the central part is faster and gradually less and less towards the sides. The difference of movements at varied parts is such that it overcomes the cohesion between the layers of wet clay and forces them to slide, one on the other, and thus is produced the lamination in the bricks.

"The same thing is taking place, in a small scale, in a die box that is filled by gravity alone.

Testing for Density of Brick

"Here is a simple test for you to determine the variation in the density of your own brick.

"Take a tray and fill it with water about ½ in. deep. Put a brick in it and watch what happens. The brick will begin to absorb the water. The wet line forms a line of demarcation all around the brick, showing the water creeping up on all faces. It gradually rises higher and higher until the entire brick is saturated with water. This test, in the first place, shows how porous the brick is. The denser the brick the longer time it requires to become saturated. In the second place, it shows the relative density of the different parts of the brick. The more uniform is the density of the brick the more evenly will rise the wet line all around the brick and more nearly parallel to the water surface in the tray.

"A die box is never filled evenly by the gravity system, and worse yet by mechanical feeders. The uneven filling of the die box is an inherent weakness in all types of presses. My conclusion on this factor as far back as 16 years ago was that: 'Something has to be done to counteract this natural shortcoming. The heavy pressure that some people resort to, to overcome this trouble, is not the right solution.' The idea came to me that if I put a greater depth of loose material all around in a die box than at the center, and apply pressure to make a flat brick, I compact this extra depth of material at the edges and the corners. By careful manipulation I can not only counteract the natural shortcoming in the filling of a die box but even go a step further and turn the balance the other way; in other words, produce a brick, the edges and corners of which will be denser than the center. A good and dense center could not protect the weak edges and corners, but the good edges and corners can protect the weak center.

An Improved Press

"I built a press along the lines of this principle and operated it with a 30-ton hydraulic jack that had a gage on it. These edges and corners speak for themselves. As I understand, in the sand-lime brick industry, 80 to 90 tons of pressure is needed to make a proper brick.

"Not only was my theory right that I could produce better edges and corners with this device, but also I was able to secure the results with less than 50% of the pressure used by the industry today.

"Bricks made with this principle will have better showing in any tests that now are applied to determine the quality of a brick. For example: (1) Tumbling test; (2) crushing test; (3) stability test; (4) beam test.

"This principle can be easily applied to any existing press in operation in any plant.

Asphalt Impregnated Paving Brick

"Two of the most used pavements are the asphaltic and the cement concrete pavements.

"Asphaltic pavements require a good, firm foundation upon which to lay the asphaltic part, as a carpet is laid on a wooden floor.

"Cement concrete pavement is made of cement and broken stone. It does not need any asphalt in its make-up.

"Each of these two types of pavement has its good and its objectionable features.

"For years I have been thinking, studying and experimenting with the hope of combining the asphalt and concrete in one. If I could do that, I would be able to unite their good points and perhaps do away with their objectionable features and produce a pavement better than either one alone.

"A few years ago my experiment along this line gave me some results. I am able to induce the asphalt to enter into concrete or brick or any other porous material in an open tank without any vacuum or pressure. This is done by giving to the material certain treatment first, then submerging it into an asphalt bath. This method of impregnation requires that the material be heated uniformly as hot as the asphalt just before it is dropped into the asphalt bath. Of course I cannot use this method on a concrete pavement already laid, but there are other materials that can be treated and impregnated with asphalt or any other waterproofing agents that can be used as paving, building and roofing material.

"In Germany the sand-lime brick is impregnated with asphalt by the use of vacuum and pressure method. This method requires expensive machinery, more labor and longer time, therefore it is a costly process.

Advantages of Asphalt Treatment

"These asphalt impregnated bricks are used in Germany for paving with considerable success. If you consider and compare the merits of such a pavement with the standard asphaltic pavements, say, with sheet asphalt and asphalt block, you will ask, 'Why not?' What is sheet asphalt? Sand and dust mixed with asphalt and after spreading on the street while hot, is rolled. Asphalt block is composed of crushed rock, dust and asphalt mixed and compressed in a press while hot. If it was not for the small percentage of asphalt used as cementing agent,

sand and dust in the sheet asphalt or crushed stone and dust in the asphalt block could not in the first place stand under the traffic for two minutes. In the second place, no matter how much they are rolled or compressed, they are still more or less porous. Besides these, an asphaltic pavement always yields under a stationary load, no matter how small the load is.

"When a sand-lime brick is impregnated with asphalt the strength of sheet asphalt pavement is added to its own structural strength. It will be absolutely waterproof because all of its voids are filled with asphalt. Its crushing and tensile strength greatly increases with asphalt impregnation, and does not yield under ordinary load like asphalt pavement. Therefore, it makes an excellent paving material, especially for factory floors where most other paving materials fail.

"Asphalt impregnated sand-lime brick is not brittle and under hammer blows, instead of crumbling it acts like lead; it absorbs the blows and does not crumble.

"Asphalt impregnated sand-lime brick being absolutely waterproof is best suited for subway and sub-cellar walls. It will not only act as waterproofing medium, but will also support the load as part of the wall itself.

"Asphalt impregnated brick is not only waterproof but is also electricproof. It can be used for any kind of conduits for electric wires and cables.

Waterproof Walls

"I have been told by a number of high authorities on building industry that the present cry for buildings, especially for high ones, is *dry walls.*

"If the waterproofing is applied as a thin asphaltic membrance on the inside of a wall as in present day construction, it is not a part of the wall itself. It is a layer of paste applied on the wall. It may crack; it may peel off; it may have pin holes; it will not protect the wall from the action of outer elements. The wall itself will often be wet. At the best, the waterproofing applied on the inside of a wall is an imitation of the real thing wanted, but so far has not been found.

"With this impregnation process sand-lime brick also can be made waterproof on one face only, and can be colored to any desired color—red, green, buff, etc. In that case it will be cheaper than total impregnation and better suited to building construction with the use of ordinary mortar joint, because the part that is not made waterproof will remain porous to adhere to the mortar.

"Walls constructed with bricks having outer face waterproofed and laid in ordinary mortar will produce an absolutely dry and waterproofed wall, when the joints are raked to a little depth and pointed with a waterproof compound, to suit the color of the brick.

Some New Products Possible

"With the sand-lime brick mixture, the following articles can be made, and when they are impregnated with a colored waterproofing agent, there will be some new and useful products added to the sand-lime brick industry. For example: (1) Blocks, like the concrete or cinder blocks; (2) roof tiles, like the clay and concrete tiles and slabs; (3) roof shingles, like the slate and asbestos shingles; (4) pipes, like the clay and concrete pipe; (5) burial vaults, like the concrete and asphalt burial vaults.

"This impregnating process can be successfully used on all these articles made of concrete, clay or any other composition, but sand-lime brick mixture has decided advantages over the rest.

"In the first place, with this process the waterproofing agents must be heated to become liquid, and the article to be treated must also be heated uniformly just to the temperature of the waterproofing agent. Sand-lime brick is nearly at the right temperature when it comes out of the curing cylinder for the most effective treatment and impregnation.

"Articles made of clay or concrete must be especially heated and insured that the desired temperature is uniform throughout the body. To do so naturally increases the cost.

"In the second place, with the sand-lime brick mixture any article can be made today and by tomorrow it is cured, treated, impregnated and ready for the market, while for clay and concrete products weeks and sometimes months of time are required. This means larger plant and capital tied up in stocks, in proportion to the time consumed in manufacturing of an article."

Manufacturing and Operating Problems

H. J. Levine (National Brick Corp., Long Island City, N. Y.) read a paper on "Handling Bulk Lime by Suction," which is produced herewith practically in full:

Handling Bulk Lime With Pneumatic Conveyors

"In the manufacture of any commodity where quantity production is essential to its profitable marketing, and especially where that commodity is both heavy and low in unit cost, the problem of handling, conveying and distributing the various ingredients making up that product is one of prime importance.

"In our particular industry, the materials we are called upon to handle are sand and lime. Depending upon local conditions existing at individual plants, the conveying and distribution of sand is generally easily and efficiently accomplished by the use of a combination of bucket elevators and belt conveyors. Lime, however, due to special properties inherent in that material and due to the fact that it must necessarily be delivered to the plant protected from the weather, does not lend itself so satisfactorily to the same methods of unloading and conveying as does sand. In most plants the bulk lime is delivered in box cars; men are sent in with shovels or a power shovel and unload the lime into a special receiver whence it is conveyed by bucket elevator to the hydrator bins or storage silos. This method has many obvious disadvantages which will be discussed later. Our company, forewarned, investigated and studied all forms of handling lime and finally decided on the method of handling bulk lime by pneumatic conveyors, which is the subject matter of this paper.

"It is not my intention to give you any of the technical details of the working of the pneumatic conveyor but rather to give you a simple description of the actual operation of this system as we have installed it in our plant, together with the advantages we believe it possesses over the purely mechanical method of handling lime, and some practical information which might be of service to those of you that might consider installing such a system in your own plant.

"In order to fully understand the operation of this system a brief description of our plant must here be given. We use the so-called hydration system. Our hydrator room is located at the side of our factory nearest our dock and about 70 ft. back from the bulkhead lime. The hydrators are located on the second floor level about 30 ft. above the level of the dock. After hydration, the hydrate is carried by screw conveyors and deposited in six storage bins directly below the hydrator room floor. Outside on the dock and in line with our hydrators we have a steel storage bin for raw lime having a capacity of about 190 tons. Our lime is delivered at our dock on a railroad float having four cars, two abreast of each other.

Pneumatic Unloading of Lime

"The work our pneumatic conveying system accomplishes is this: It unloads our cars of lime, conveys the lime to a receiving hopper located directly above the hydrator hoppers, from which it is dropped through a discharging lock into either one of the two hydrator hoppers, and when these hoppers are both full (due to the fact that the pneumatic conveyor has an actual capacity of about 10 tons per hour, and our hydrators have only a combined capacity of about 6

tons per hour) the lime is dropped by gravity into our steel storage bin, which is equipped with an intake hopper at the bottom of the bin with a cut-off valve, from which the raw lime can be reclaimed, by the same system, into the hydrator bins, after all the cars have been unloaded.

Features of the System

"The component parts of the pneumatic conveying system are a combined receiving hopper and bag filters weighing about 5 tons which is located on an independent steel support located about 10 ft. above the hydrator bins. The bottom of the receiving hopper is equipped with a four-compartment discharging lock which is kept revolving by a 2-hp. motor, in such manner that the material is being continuously discharged, while at the same time the bottom of the hopper is hermetically sealed so that the vacuum in the system is always maintained. The function of the filter bags is to collect all the fine particles of lime that might otherwise be lost, and a shaker device operated by compressed air of about 45-lb. pressure, automatically and at regular short intervals shakes the filters free of these fine particles and permits them also to be discharged along with the bulkier pieces of lime. A vacuum pump operated by a belt drive from a 50-hp. motor is located on the floor of the factory, which by means of an 8-in. pipe connected with the top of the receiving hopper and filter draws out all the air from the hopper and discharges the air free from any trace of lime into the outside atmosphere. From the intake end of the receiving hopper a pipe line varying from 4 in. and decreasing to 3½ in. in diameter is run down alongside the building and then out to within a few feet of the edge of the dock, where a cut-off valve is installed. When we are unloading from the cars, flexible rubber hoses with a nozzle at the end are attached to this valve, which reach into the cars.

Operating Details

"The operation of this system is extremely simple. One man pulls the flexible hose into the car which is to be unloaded and plunges the nozzle deep into the lime. The motor operating the vacuum pump and the small motor geared to the revolving discharge lock are simultaneously started. The vacuum pump draws air at a high velocity through the hose and conveying pipe with force sufficient to carry the lime with it. When the air and lime reach the receiving hopper, its velocity is suddenly diminished due to the much greater cross-section of the hopper over the cross-section of the conveyor pipe and the material is trapped in the receiver where it is discharged through the unloading lock. The finer particles of lime are trapped by the bags in the filters and the air, after being relieved of the material, is drawn through the pump and discharged into the atmosphere. Similarly when lime is to be reclaimed from the steel storage bin the cut-off valve on the bottom of the bin is opened, the pump is operated and the material is drawn into the receiving hoppers as before.

Advantages

"The advantages we have found from our experience with this system are: (1) Freedom from raising dust which burns the hands, face and eyes of the worker unloading lime by hand or by power shovel; (2) flexibility of the location of incoming cars of lime within reasonable limits, as more sections of hose may be added to reach cars further distant from our intake pipe line; (3) independent of weather conditions as the lime may be unloaded in all kinds of weather; (4) no loss of material; (5) cleanliness of operation; no dust released anywhere in the plant from this operation; (6) simplicity of all working parts of this system, conducive to low upkeep and few repairs; (7) small reduction in the cost of handling the material; (8) no yard space is required for any equipment or conveying apparatus.

Factors Governing Installation

"In considering the installation of a pneumatic system for conveying lime, many factors should be carefully weighed. The advantages cited above should be balanced against the initial cost of the system, the number of tons of lime used per year, and the storage capacity of the plant. Alterations of the factory may be involved as the receiving bin and filters must be located about 10 ft. above hydrator bins or silos and the receiver itself measures about 18 ft. in height. This receiver and filter (weighing about 5 tons) is subject to considerable vibration caused by the shaking device of the filter bags and should be independently and substantially supported. The piping should have tongue and grooved flanges to maintain a uniform cross-section of pipe, allowing free and unobstructed passage of the material; should be made up of straight sections as far as conditions will permit and have as few bends or curves as possible; wherever bends are required they should have at least a 6-ft. radius and be not more than 45 deg. curve, if possible. Improper piping will seriously curtail the capacity of the system. The vacuum pump should be of sturdy construction but of the simplest rotor type.

Simple Systems Preferable

"There are many makes of pneumatic conveying systems, but great care should be exercised in the selection of the one best adapted to do the work required. In this connection, it should be clearly remembered that what we are after is a system as simple as possible to unload our material at its place of arrival and to deliver it to the place where it is to be stored or hydrated. In our opinion this is best accomplished by a system drawing or 'sucking' it up directly to its place of delivery rather than by any 'blowing' or more complicated system of 'sucking' it to an intermediate point and then 'blowing' it to its final destination.

"The above description and other information concerning the pneumatic system as used by our company in the handling of our raw lime, I trust has been of some interest and some little value to the members of this association, and in concluding I wish to add that we have also experimented with the pneumatic conveying of the hydrated lime, which has proven to be a more complicated problem to solve. We feel, however, that we are well on our way to overcome the obstacles we encountered, and hope that at our next meeting we will be able to give you the results of our efforts in this direction."

Cleaning Car Tops

W. A. Smyth (York Sandstone Brick Co., Ltd., Toronto, Ont.) read a very interesting paper on cleaning car tops by sand blasting, which aroused much interesting discussion and comment. His paper is reproduced practically in full, as follows:

"An ever-present problem in plant economy is that of keeping down to a minimum the wastage or breaking of brick while in the green state. Naturally, many factors present in the manufacturing processes up to the time of pressing, such as proper grading of sand, correct mix, proper moisture content, etc., determine to a considerable extent the amount of subsequent breakage; yet I believe it to be the general experience that a very high percentage of well-made brick are ruined in handling before steaming.

"A few years ago our company, alarmed at the high rate of wastage shown, made a determined effort to plug up the leak; and our investigations at that time showed that breakage preponderated considerably on the lower rows of brick on the cars. This led further, and forcibly directed attention to the car tops themselves, which were badly coated with scale.

Scale Troublesome and Costly

"Every manufacturer sooner or later comes to know the accumulation of flinty scale which gradually makes its appearance upon the car tops. He may neglect it for several years, but if he does it will prove to be a very troublesome and costly oversight.

"Our condition was aggravated by the fact that our cars are comparatively narrow; we make a $2\frac{7}{16}$-in. brick, and thus have to pile very high in order to get a thousand brick on each car. Thus, the extreme weight which was placed upon the bottom rows, coupled with the fact that they lay upon broken and uneven surface, produced the inevitable results, which usually appeared as a jagged crack extending across the whole bottom row. Unfortunately the trouble did not as a rule there, but quite often extended to the rows next on top, with an

effect somewhat similar to failure in solid masonry.

"Also contributing to this condition, is the swaying of each tier occasioned upon the starting or stopping of the cars. It is admittedly difficult to find a lubricant for car-wheel bearings which will stand up against the cylinder conditions, particularly with old type bearings; and the result is at times difficulty in starting loaded cars to move, necessitating the use of pinch bars under the wheels, with a resultant jerky motion of the cars. This will cause swaying of the tiers, with the bottom rows of brick acting as axis. The severe strain thus set up must result in damage to the new brick, if the surface of the car is in the least uneven. We have found that the insertion of a finished brick in the center of each tier, acting as a tie brick between the tiers, counteracts to a great extent the tendency for the brick to sway.

"However, it is apparent that, no matter what precautions are taken, trouble will always be encountered as long as accumulated scale is present upon car tops in the uneven form which it usually assumes.

Experiments as to Removal of Scale

"During the year 1924 we tried several methods for removal of scale, but success seemed remote. Scale had been accumulating for over 12 years, and while unevenly distributed, had in places reached ¼-in. in thickness. Our inquiries led us to believe that there was at that time no grinder which would handle the problem in a consistently satisfactory manner, and correspondence which we instituted seemed to bear out that fact. The matter was taken up with technical authorities, and under their direction compounds were formed in which to immerse car tops. None of these gave the desired result.

Cleaning by Sand-Blast

"At this stage it was decided to experiment with the process of sand blasting, our T. J. Smyth being of the opinion that it would solve our problem. In order to try out the idea, a working arrangement was made with a foundry which was using sand blast extensively, and we sent to their plant several car tops to be given an experimental cleaning. Upon being subjected to sand blasting the scale entirely disappeared, and the tops were as smooth as when new. We were at once sold on the idea.

"Our idea at first was to have this work done outside our plant, but we were forced to abandon it. The best price we could secure was $2 per car top, $500 for the lot, which, when added to the expense of dismantling and reassembling, made the cost excessive.

"It was therefore decided to install a compressor and sand blast of our own to do the work. Not being actively familiar with this application of compressed air, and never having known it to be used for this purpose, we naturally had to begin at the beginning. However, we were fortunate in picking up an Ingersoll-Rand 12x8-in. compressor, Type N. E. 1, together with sand blast and motor, at a very reasonable price, as the former owners were installing more up-to-date equipment.

Utility of Process

"For those not familiar with the operation of sand blasting, I will give a brief description. A stream of sand, possessing special abrasive properties, discharged through a nozzle by the force of compressed air, is directed upon the surface to be cleaned. Ordinarily the equipment consists of compresor and driver, air tank and the sand blast proper, which in the stationary types is a tank container for the sand, which automatically feeds it into the hose line through which the compressed air is passing.

"We are of the opinion that there is no other process of cleaning car tops which can do a better job than sand blasting; for the reason that sand blast is 100% efficient. The car top is finished as clean as the day it was first made. The points to be considered therefore are utility and cost.

"For those plants which already have compressed air installed for other purposes, the expense would not be great. The cheapest form of sand blast equipment on the market is the device known as the Stowe 'Multi-Blaster' and, as it is only necessary to clean car tops once each year, I think that this type would be very suitable for brick plants. No sand tank is required in the operation of this device, as it sucks up the sand from a pail or any kind of open container. These are made in several sizes and cost from $15 to $30, f. o. b. Buffalo, N. Y. They cannot of course be compared in efficiency with the larger stationary plants nor the better classes of portable equipment, but I believe that they would be satisfactory for our type of work. We have not experimented with this equipment and cannot give first hand information, but I am informed that they are widely used by railroads for cleaning tank cars ,steel box cars, etc.

Portable Outfit Suitable

"The outstanding makers of sand-blast equipment are the Mott Co., Chicago, the Pangborn Co., Hagerstown, Md., and the W. W. Sly Manufacturing Co., Cleveland. The Pangborn Co. makes a small portable outfit for use in the monumental trade. The modern way of lettering on stones, etc., is to cover the stone with a composition stencil and then sand blast it. In this way the flying sand cuts out the part of the stone not protected by the stencil. These outfits are said to be much cheaper and to require less air than the large foundry equipment in general use.

"For those plants which have no compressed air now installed, a compressor would be necessary. The latest type of straight-line, single-stage compressor corresponding to our N. E. 1 is the Ingersoll-Rand E. R. 1. The smallest of this type is the 6x6-in. machine, having a displacement of 67 cu. ft. of air per minute at a pressure of 150 lb., and would cost $550 without accessories or driver. We do not believe that such a large machine is needed.

Only a Small Unit Needed

"For intermittent service, such as a brick plant would give it, the small, single-cylinder vertical machine would probably be the best investment. The Ingersoll-Rand 6x6-in., Type 14 machine has a piston displacement of 44 cu. ft. at 100 lb., and in the belt-driven style would sell for around $235. It would probably take care of the two smaller sizes of the Stowe 'Multi-Blaster.' A still smaller unit would be the 4½x5-in. Type 15 machine with a displacement of 23 cu. ft. This machine with short belt drive complete with 60-cycle motor costs around $375. It may or may not be large enough to do the work. Experiment would be necessary. All prices given are f.o.b. Canadian factories, and in the United States would perhaps be lower.

"The above are a few types of machines at present on the market. I believe that a small amount of experimental work, carried on by an interested party in conjunction with any of the manufacturers of compressed-air equipment, would result in the production of a combined unit at a low cost, which would be popular around a sand-lime brick plant.

Sundry Operating Notes

"Supply of blasting sand is not a serious item. The grade which we use is No. 3½, originates at Farmingdale, N. J., and costs $3.30 per ton, f.o.b. that point. The sand may be used over several times before being finally broken down. We estimate about 85 lb. of blast sand per car top cleaned.

"Two men are required for the operation of our unit, one man to handle the nozzle, and one to remove finished cars, prepare cars for cleaning, gather up used sand, etc. Actual cleaning time per car is about 20 minutes; and allowing for handling of cars and other work about 20 cars per day of 10 hours can be finished. Skilled workers are not necessary, as any intelligent laborer can do the work. Labor cost is about 40c per car. Pressure to be used varies with the quantity of scale on the car; and we find that, when our cars are cleaned every year, about 40 lb. tank pressure is sufficient.

"Proper ventilation of the room in which blasting is done is essential, owing to the amount of dust raised. We have installed a No. 8 Sheldon exhauster, which is coupled with our machine shop main drive shaft, and it amply cares for ventilation.

Economies Effected

"Following are a few figures illustrating the saving effected by the cleaning of car

tops: During the months of June, July and August, 1925, immediately prior to the installation of this outfit, the rate of breakage on brick handled amounted to 3.8%. During the ensuing three months the cars were cleaned by degrees as the opportunity presented itself. The rate of breakage gradually reduced itself to 1.9%. For the first six operating months of the year 1926, when all cars had been cleaned, the rate of breakage fell away to the surprising figure of seven-tenths of 1%. This was on a monthly average handling of 1,750,000 brick, or an average monthly saving of 54,250 brick, which at the then prevailing price of $12.50 per thousand in the yard, represented a monthly saving of $678.12."

Home-Made Car Top Cleaner

John L. Jackson and **J. Morley Zander** (Saginaw Brick Co., Saginaw, Mich.) discussed Mr. Smyth's paper and described a very simple device developed at their Saginaw plant for cleaning car tops which consisted merely of running a car on a turntable and placing another car, top down, against the top of the first car. The superintendent then rigged up a simple reciprocating device with scrap pieces of equipment about the plant which caused the top car to move back and forth across the lower one, grinding the two tops together. With this simple device they were able to clean from six to ten cars a day, with practically no cost except for the small amount of power consumed, as the apparatus could be set in motion and left.

E. D. Church (Jackson and Church Co., Saginaw, Mich.) submitted a paper which was read by John R. Kauffman, on recent improvements in sand-lime brick machinery, which described in some detail the new improved brick press recently developed by his company and described in the "New Machinery and Equipment" department of Rock Products, January 4, 1930.

W. H. Withington (Hardinge Co., Inc., York, Penn.) read a paper on "The Rod Mill and Its Functions in the Manufacture of Sand-Lime Brick," which is reproduced practically in full in what follows:

Rod Mills

"The rod mill or bar mill, as it is sometimes called in the sand-lime brick industry, consists essentially of a cylinder whose length is approximately twice its diameter. In commercial sizes the cylinders vary from 3 ft. to 8 ft. in diameter and 6 ft. to 16 ft. in length. To each end of the cylinder is attached a head with a hollow trunnion cast integral, by means of which the cylinder is supported. The trunnions, which are usually from 23 in. to 33 in. in diameter, rest in heavy babbitted bearings, which in turn are supported by concrete foundations or other rigid supports.

"The cylinder is rotated by means of a girth gear around the cylinder which is actuated by a pinion on a countershaft parallel with the axis of the mill. The countershaft may be direct connected to the motor, or driven from a motor or line shaft by means of a belt, Texrope, or chain drive. The interior of the cylinder and heads are lined with steel or special chilled iron lining plates approximately 2 in. thick.

Mill Construction and Filling

"The grinding media consist of steel rods from 2 in. to 4 in. in diameter and approximately the length of the cylindrical section of the mill. The quantity or weight of rods to be used depends in each case upon the particular requirements of the problem. In general the rod charge never occupies more than one-half of the internal volume of the mill, and usually not more than two-fifths.

"The cylindrical lining is so constructed that it will lift the rods with a minimum of slippage as the mill is rotated and thus cause them to cascade and roll over the material passing through the mill.

"The material to be pulverized is fed continuously into one end of the mill through the hollow trunnion or an opening in the feed head. It is discharged continually at the opposite end of the mill through the trunnion, or openings in the discharge head, or through slotted openings in the periphery of the cylinder at the discharge end of the mill. The latter arrangement is necessary when handling a damp or inert material, and it is the arrangement most generally used in sand-lime brick plants.

"There are several other methods for supporting the cylinder of the mill. Instead of using trunnions and bearings, some manufacturers support the cylinder on two steel tires which are in turn supported by bearing wheels. Two or four bearing wheels are used to support each tire and thrust wheels are placed on either side of the tire to prevent a lateral movement of the mill. Still another method is to support the feed end of the cylinder by means of a trunnion and to use a steel tire and bearing wheels under the discharge end.

Selecting the Rod Mill

"It is not the intention of this paper to compare the relative merits of the design and construction of various types of rod mills, but the following fundamentals should be kept in mind when selecting this type of equipment:

"1. To select a mill which is simple, and with the fewest moving parts; 2. The mill should be fool-proof, and all parts should be accessible for inspection and repairs; 3. The lining should be sectionalized so that each piece will weigh less than 200 lb. and will be small enough to pass through a manhole or trunnion opening, so that it is not necessary to dismantle the mill in order to reline it; 4. The mill should be rugged, but not burdened with excess weight which does not contribute directly to its strength.

"The rod mill was first used in Germany about 35 years ago. It came into prominence in this country about 12 years ago when it was used in the mining industry for the wet grinding of ores. The rod mill made its appearance in the sand-lime brick industry in 1920, when the first mill of this type was installed by W. H. Crume in the plant of the Crume Brick Co., Dayton, Ohio. Prior to that time the grinding of the sand, pulverizing of the lime, and intimate mixing of the sand, lime and water were considered separate operations.

Simultaneous Grinding of Sand and Lime

"In an effort to find equipment which would improve this stage of the process and reduce production costs, Mr. Crume became interested in the rod mill, which until that time had been used exclusively in the mining industry. It was his intention to use this machine to pulverize the sand and gravel prior to feeding the material to the dry pans. It was soon found, however, that this equipment was not only capable of grinding the sand, but that it could simultaneously mix in the lime and water and deliver a product far superior to that previously obtained from the old system.

"The original mill was 4 ft. in diameter by 9 ft. long. It was charged with 9 tons of steel rods approximately 9 ft. long, and driven by a 50-hp. motor. Provision was made to tilt the mill so that its slope could be changed at will. The capacity obtained proved conclusively that this mill could prepare sufficient material for at least 6,000 bricks per hour. It was also found that the rod mill made the operation continuous, provided a more perfect control over the product, eliminated the inefficient wet pans with their attendant labor, saved power and occupied considerably less space in the plant. The installation was an unqualified success. The rod mill was adopted by the industry, and is today quite generally used.

The 4-Ft. Mill Popular

"It is an interesting fact that for approximately 8 years following the installation of the first mill by Mr. Crume, the same size of mill was invariably used throughout the industry when replacing old equipment and when new plants were erected. Regardless of the capacity requirements of the plant, or the amount of grinding necessary for the sand, the 4-ft. mill was selected. If the plant capacity was too large for one 4-ft. mill, then two or more units of this size were installed.

"Whether the pioneering spirit which was responsible for the introduction of the rod mill was dormant during this period, or whether other matters of more importance occupied the time and attention of the operators, the fact remains that for a period of approximately 8 years there was very little effort made to improve the operation of the

rod mill or to ascertain its greater possibilities.

Improving the Design

"Several years ago, however, the rod mill again became the object of serious consideration. Two forces were at work, one from within the industry, and the other from without. C. H. Carmichael of the American Brick Co., Boston, Mass., began a series of large scale tests to determine the advantages to be gained by grinding finer in the rod mills. At about the same time one of the leading manufacturers of rod mills became interested in the possibilities of improving the operation of rod mills in sand-lime brick plants, particularly from the standpoint of reducing mechanical difficulites to a minimum. Their separate investigations have contributed much to the art and are likely to have considerable bearing upon the future trend of the industry when their full significance is realized.

"The mechanical investigation brought out many interesting facts. It was found that when conical heads were used on the mill, the ends of the rods did not scrape against the head liners. The life of the discharge end liners was increased more than 10 times, and wear on the ends of the rods was reduced approximately to one-fifth of the former wear.

Advantages of Conical Head

"The use of the conical head on the feed end of the mill also provided a chamber for the incoming feed so that the flow of material was not obstructed by the ends of the rods, regardless of the height of the rod charge in the mill. Introducing the feed under the ends of the rods as it entered the mill, rather than over the top of the rod charge, was found to be equivalent to adding approximately one foot to the length of the mill.

"It was also learned that it was not necessary to place the mill on a slope if the proper ratios were maintained between the diameter and length of the cylinder, and the mill speed. By increasing the diameter of the mill, it was found that grinding efficiency increased, due to the greater superincumbent weight of the rod charge.

"All of these may be considered as mechanical improvements. The results of the investigation in finer grinding by Mr. Carmichael, however, deserves your careful consideration.

Fine Grinding Experiments

"The equipment used for the fine grinding experiments consisted of a 4-ft. by 10-ft. rod mill, installed on a slope of approximately ½-in. per foot. The mill was charged with 5 tons of rods and was driven by a 50-hp. motor.

"The first test was made with a poor sand which was very soft and fine. The sand, lime and water were fed to the mill at a rate to produce 6,500 bricks per hour. Fifty samples were tested from the brick made from this operation, with the following results:

Average weight of brick..... 4.54 lb.
Average transverse breaking load....729 lb.
Average modulus of rupture.....405 lb.
Average moisture content in the green brick, 5.8%.

"The bricks produced in this test were not acceptable.

"The second test was made with the same sand, and with the same percentages of lime and water, but the material was run through the mill twice, which was equivalent to doubling the grinding time.

"Fifty samples from this test showed a decided improvement:

Average weight of brick..... 4.6 lb.
Average transverse breaking load....874 lb.
Average modulus of rupture.....484 lb.
Average moisture content in the green brick, 5.8%.

"The strength of the brick was increased approximately 20%, and the average weight was also increased.

Extra Grinding Allows Use of Poorer Grade of Sand

"A similar test was made on another poor grade of sand to determine whether acceptable brick could be made from poor sand by extra grinding. The test proved that it was possible to do so.

"Sample bricks made from the material after passing through the mill once did not pass the acceptance test. Samples from the material which had been ground twice were acceptable. The comparative results are tabulated as follows:

	Single Grinding	Double Grinding
Average weight of brick.....	4.5 lb.	4.53 lb.
Average transverse breaking load	717 lb.	910 lb.
Average modulus of rupture	397 lb.	503 lb.

"The strength of the brick was therefore increased approximately 26% by double grinding.

"The fourth test shows the results of single and double grinding with a good sand. The lime and moisture content were the same in each mix.

	Single Grinding	Double Grinding
Average weight of brick.....	4.41 lb.	4.43 lb.
Average transverse breaking load	1318 lb.	1470 lb.
Average modulus of rupture	728 lb.	813 lb.

Double Grinding Improves Product

"In each of the tests conducted, double grinding was found to have improved the product. The brick made from the double-ground material was found to be stronger and heavier in each case. The sand particles after double grinding were found to be completely coated with lime.

"It was not possible to make comparative screen analyses between the feed to the mill and the product after single and double grinding, as the coating of the lime on the sand particles builds up the size of the sand grains to such an extent that a screen analysis of the ground product often shows a smaller percentage of fine material than was present in the material as fed to the mill.

"Where good sand is being used and additional strength is not required, extra grinding would make it possible to decrease the lime content, without sacrificing strength of the brick.

Larger Mill Proves Satisfactory

"In order to take advantage of the results which had been obtained by double grinding, it was decided to install a mill 6 ft. in diameter by 12 ft. long. The effective internal volume of the 6-ft. by 12-ft. mill is nearly three times that of the 4-ft. by 10-ft. mill, so that if fed at the same rate as the 4-ft. by 10-ft. mill, the material would be retained in the grinding zone nearly three times as long and subjected to nearly three times the amount of grinding.

"The 6-ft. by 12-ft. mill was installed with its cylinder level, and embodied the improved mechanical features mentioned above. It was charged with approximately 15 tons of rods and fed at a rate sufficient to produce 7,500 bricks per hour. This unit has fully confirmed the results of the tests on the 4-ft. by 10-ft. mill. The strength and weight of the brick have been increased and lime nodules have been completely eliminated by finer grinding.

"The breaking load of the brick representing regular production varies between 850 and 1,500 lb., with the average being approximately 1,100 lb. The weight of the brick varies between 4.6 lb. and 4.8 lb. More important, however, is the fact that all of the brick manufactured now pass the acceptance test. This is of great importance from the sales standpoint, to say nothing of its effect upon the operator's peace of mind.

"The additional power required for operating the 6-ft. mill adds to the cost of production approximately 7c per 1,000 brick. Maintenance costs are expected to be very low. No repairs have been made during the seven months that this unit has operated.

"From the foregoing, it is evident that finer grinding offers an extensive field for research in this industry, as the tests so far made only represent a good beginning.

"Experiments along these lines can easily and economically be conducted by those now using rod mills.

"Reliable manufacturers of grinding equipment should be consulted and their co-operation sought when such tests are conducted. Their diversified experience in other fields may provide just the knowledge required to solve your particular problem."

Research

T. C. Tayler (Sand-Lime Products Co., Detroit, Mich.), under the title of "Brick Engineering," discussed the practice of brick engineering and touched largely upon the advantage and benefits from research, and

outlined in detail how research work may be accomplished through various established laboratories such as the Bureau of Standards and those provided by various universities and engineering schools. He also suggested what he called subsidized research at the plants of the members of the association through the offering of substantial cash prizes to members for the finding and publication of all important developments, both in operation and product.

Miscellaneous

Various interesting papers were read which did not bear directly on the manufacture and use of sand-lime brick.

W. K. Squier (Paragon Plaster Co., Syracuse, N. Y.) gave a brief resumé of the new New York state lien law and how it affected producers of building materials. He said that the construction industry had been operating under a law written on the statutes in 1885 which had become entirely out of date, and that while the new law did not go so far as it should to protect the producer, it was a great improvement over the old law. The New York state law abolishes priority in the matter of liens in so far as labor is concerned and is designed to prevent the diversion of trust funds raised specifically for building to other purposes than the liquidation of debts in connection with the construction of the building.

Larger Brick Favored

P. H. H. Dunn (secretary of committee and representative of Division of Simplified Practice, U. S. Bureau of Standards, Washington, D. C.) made a plea for co-operation of sand-lime brick manufacturers in connection with the work of the various organizations interested in standardizing masonry openings, which of course includes ultimately standardization of building units, and led to a discussion of the best size of brick.

All members seemed in favor of a larger brick than the present standard size, but to obtain such a standard requires the abandonment of the present standard which was a long time in the course of adoption, and the co-operation of all manufacturers of masonry wall materials, so that no action could be taken other than that the association was in sympathy with the work of the committee.

J. M. Porter (research engineer, Structural Gypsum Co., Linden, N. J.), an old friend and honorary member of the association because of his former connection with the U. S. Bureau of Standards, read a paper on "Gypsum Products, Old and New," which in general terms described gypsum and gypsum products.

C. E. Ellsworth (chief engineer, construction division, National Lime Association, Washington, D. C.), gave an interesting talk on "Mortars and Masonry," coming to the conclusion that for water-tightness and plasticity mortar should have a high lime content.

Association Affairs

W. W. Dohany (secretary, Michigan Sand-Lime Brick Association) submitted a paper on the work of the Michigan Sand-Lime Brick Association, which was organized in 1927, and through a fund provided by its members, based on 6c per thousand brick, had been able to do very effective publicity and contact work with architects and builders in Detroit and vicinity. He said it was astonishing, even in Detroit where sand-lime brick has long been on the market and in larger quantities than almost any other locality in the United States, how little was known about sand-lime brick, and strongly urged the national association to do more advertising and promotional work.

Absorption Test to Be Eliminated

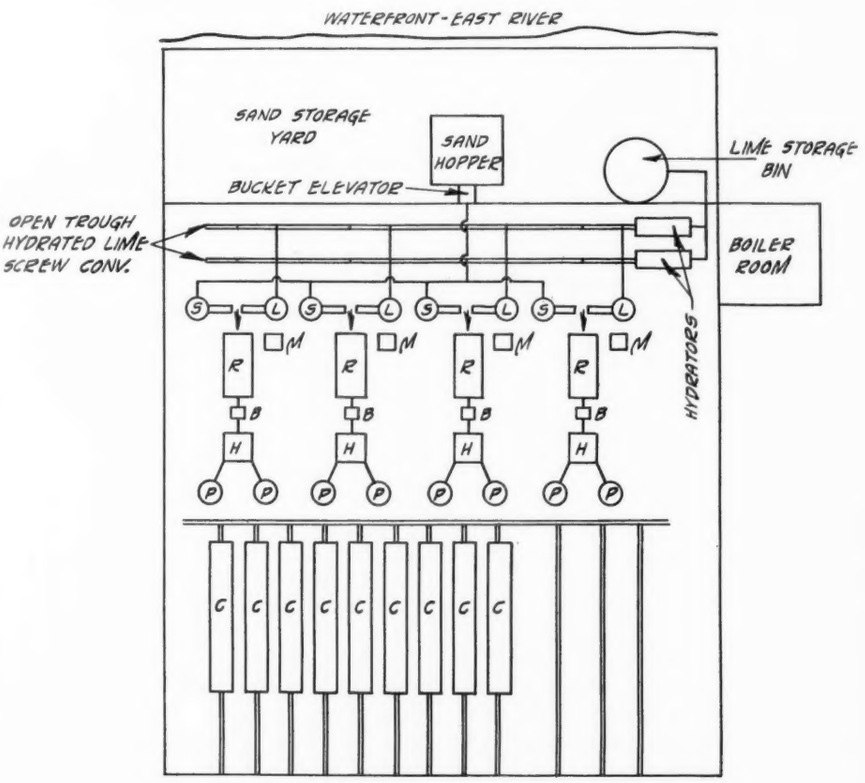
W. H. Crume (Crume Brick Co., Dayton, Ohio) briefly described the activities of the brick committee of the American Society for Testing Materials, stating that the committee had decided to eliminate the absorption test from the present tentative standard specifications and to depend entirely on transverse and compression tests. The reason for this is that no practical value of the absorption test has yet been shown.

John L. Jackson, urging publicity and advertising on the part of the association, reviewed its history for 26 years, and made a very eloquent plea for a campaign of education. He also summarized the outlook for business conditions this year, based on the reports of the National Business Conference held last December under the auspices of the Chamber of Commerce of the United States, and concluded that the outlook was very promising.

He stated that apparently the sand-lime brick industry fared very much better in 1929 than some of the other building material industries, particularly the common clay brick industry; his own companies, for example, while two of them showed declines of from 6 to 10%, the third one had more than made up for it with an increased production, and if this condition was typical of the industry, the sand-lime brick industry was undoubtedly in a better position than the other building material manufacturers.

J. Morley Zander (Saginaw Brick Co., Saginaw, Mich.) reported the results of his trip to the common clay brick manufacturers' federal trade practice conference at Memphis, Tenn., and read the code of business practice adopted there by the common clay brick manufacturers and discussed the effects of this code on sand-lime brick manufacturers.

J. A. Murray (U. S. Bureau of Standards) described briefly the present activities


WATERFRONT - EAST RIVER
SAND STORAGE YARD
SAND HOPPER
LIME STORAGE BIN
BUCKET ELEVATOR
OPEN TROUGH HYDRATED LIME SCREW CONV.
BOILER ROOM
HYDRATORS
S L S L S L S L
M M M M
R R R R
B B B B
H H H H
P P P P P P P P
C C C C C C C C C

S = SAND HOPPERS FEEDING VOLUMETERS. L = HYDRATED LIME HOPPERS FEEDING VOL-U-METERS. R = ROD MILLS. M = MOTORS DRIVING ROD MILLS. B = BUCKET ELEVATORS. H = HOPPERS FEEDING PRESSES. P = PRESSES. C = HARDENING CYLINDERS.

Plant layout, National Brick Corp., Long Island City, N. Y.

of the bureau in so far as they related to sand-lime brick. He said that there was in process a series of tests on absorption and strength of brick, including freezing and thawing tests, which would have considerable bearing to sand-lime brick manufacturers. The bureau was also experimenting with super-heated steam for making sand-lime brick and an extensive study of the chemistry involved in the manufacture of sand-lime brick was being considered. Work was also being done by the face brick manufacturers' association on wet walls to determine their cause, and these investigations of course will be of interest to sand-lime brick manufacturers as well. Involved in this is the determination of the best mortar material to use to prevent wet walls, and in connection with this experiments are being made with cement and lime mortars and combinations of the two, as well as the various mason's mortars now on the market.

Lightweight Sand-Lime Brick

Incidentally, Mr. Murray showed some samples of cylinders made of diatomaceous earth and lime by the sand-lime brick process, which had strength of from 500 lb. to 1600 lb. per sq. in. and were light enough in the case of the 500-lb. sample to float in water. He also said that the Bureau of Standards was planning to make tests of the thermal expansion of sand-lime brick, which would probably lead to some interesting results.

S. H. Ingberg, fire resistance section, U. S. Bureau of Standards, Washington, D. C.,) described with the help of lantern slides the tests of the bureau in attempting to gage the severity of building fires in order to rate various building materials according to their fire resistance.

Plants Visited

About 30 members and guests made a visit to the new plant of the National Brick Corp. at Long Island City and the Paramount Brick Corp., Brooklyn. The latter plant, put in operation early in 1928, was described in detail in Rock Products, October 27, 1928, but since that time has increased its capacity, adding several new presses and other equipment.

There were a number of interesting features about the National plant, chiefly the methods used in handling materials. Inasmuch as a complete story will appear in an early issue of Rock Products, a bare outline of the operation is given here. The plant is located on the east bank of the East river and has a dock at which barges of washed sand are unloaded. Storage piles are maintained at this dock, a small power shovel serving to carry the sand from storage to a hopper which feeds the bucket elevator to the bin storage in the upper part of the plant. From the bins, the sand is conveyed to other auxiliary bins feeding Jackson and Church Co. volumeters.

Lump lime, 1½ in. and under, is delivered to the dock in box cars on railroad barges and unloaded by pneumatic conveyor into a receiver hopper which feeds the two hydrators. After hydration, the lime is carried by screw conveyors to hoppers feeding volumeters. There are eight volumeters, four each for lime and sand; these are set up in pairs, each pair feeding into a hopper which serves a rod mill. Thus there are four rod mills, each of which is equipped with a bucket elevator to carry the ground sand-lime mix to hoppers above the presses. Each rod mill is driven by a 40-hp. motor and Texrope. The plant layout is as shown in the accompanying sketch.

Green brick from the presses are stacked on kiln cars and pushed into the hardening cylinders. There are nine of these cylinders, giving the plant a total capacity of 250,000 brick per eight hours. Two Keeler water-tube boilers supply steam for the hardening process.

Registration

Following is the registration at the convention, which is one of the largest ever held.

PRODUCERS

Acme Brick Co., Milwaukee, Wis.
I. G. Toepfer.
P. H. Toepfer.
Alsip Brick, Tile and Lumber Co., Winnipeg, Man.
E. L. Alsip.
A. A. Alsip.
American Brick Co., Boston, Mass.
C. H. Carmichael.
American Brick Co., New Orleans, La.
Otto Schwartz.
Belt Line Brick Co., Minneapolis, Minn.
John Zellie.
Boice Bros., Pontiac, Mich.
E. C. Boice.
Canada Sand Lime Brick Co., Toronto, Ont.
W. A. Kennedy.
Crume Brick Co., Dayton, Ohio.
W. H. Crume.
R. C. Kiser.
John Kauffman.
Flint Sandstone Brick Co., Flint, Mich.
G. W. Phelps.
The Grande Brick Co., Grand Rapids, Mich.
T. A. King.
G. H. Nichols.
Gray's Ferry Brick Co., Philadelphia, Penn.
T. H. Lineaweaver.
Iona Brick Co., Clayton, N. J.
W. Corbett Fisler.
Neal Newell.
Mulford F. Crane.
Michigan Pressed Brick Co., Detroit, Mich.
J. Finkbeimer.
L. Hubbard.
Mutual Materials Co., Seattle, Wash.
O. H. McGill.
National Brick Corp., Long Island City, N. Y.
H. J. Levine.
Northern Indiana Brick Co., Mishawaka, Ind.
William F. C. Dall.
Paragon Plaster Co., Syracuse, N. Y.
W. K. Squier.
Paramount Brick Works, Brooklyn, N. Y.
Lester Robbins.
Rochester Sand and Brick Co., Detroit, Mich.
J. G. Schluchter.
Saginaw Brick Co., Saginaw, Mich.
J. M. Zander.
Conrad Fern.
Sand Lime Products Co., Detroit, Mich.
T. C. Tayler.
Sebewaing Sandstone Brick Co., Sebewaing, Mich.
J. S. Palmer.
Standard Lime Co., Ltd., Montreal, Que.
J. Edmund Dorion.
Watertown Builders Supply Co., Watertown, Mass.
M. Derderian.
S. Derderian.
Winchester Brick Co., Winchester, Mass.
J. J. Gallagher.
York Sandstone Brick Co., Ltd., Toronto, Ont.
W. A. Smyth.

NON-PRODUCERS AND GUESTS

American Society for Testing Materials, Philadelphia, Penn.
R. E. Hess.
Architectural Forum, New York City
K. K. Stowell.
Bureau of Standards, Washington, D. C.
P. H. H. Dunn.
J. A. Murray.
L. S. Wells.
H. L. Whittemore.
S. H. Ingberg.
Canadian Carborundum Co., Montreal, Que.
H. C. Neeld.
Hardinge Co., Inc., York, Penn.
W. H. Withington.
G. G. Heghinian, 5528 Rusk Ave., Baltimore, Md.
Jackson and Church Co., Saginaw, Mich.
J. L. Jackson.
Louisville Cement Co., Louisville, Ky.
D. M. Gray.
W. F. Irwin, Jr.
Morehouse Machine, York, Penn.
W. S. Morehouse.
National Lime Association, Washington, D. C.
C. E. Ellsworth.
Rensselaer Polytechnic Institute, Troy, N. Y.
T. R. Lawson.
W. A. Riddell Co., Bucyrus, Ohio.
L. Haigh.
R. B. Stuckey.
Rockdale-Corson Lime Co., Plymouth Meeting, Penn.
G. and W. H. Corson.
B. L. Corson.
ROCK PRODUCTS, Chicago, Ill.
N. C. Rockwood.
Schedule Rating Office of New Jersey, Newark, N. J.
R. M. Casman.
Structural Gypsum Co., Linden, N. J.
J. M. Porter.
University of Michigan, Ann Arbor, Mich.
Prof. Good.
A. K. Walton, Hummelstown, Penn.
A. G. Walton, Philadelphia, Penn.

Beaver Portland Makes Improvements

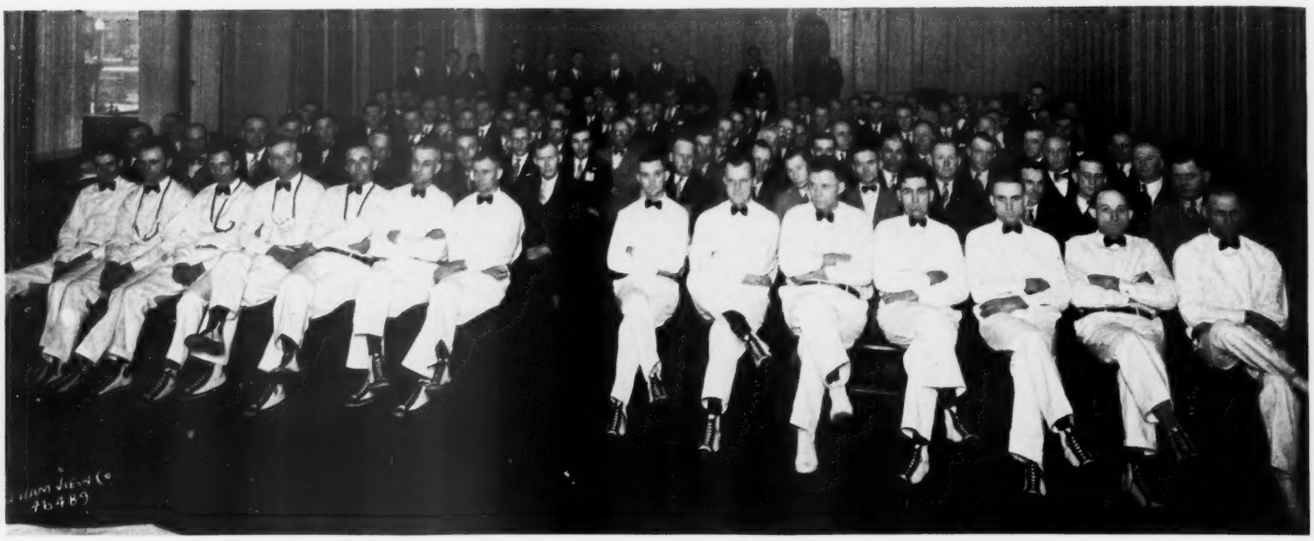
THE PLANT of the Beaver Portland Cement Co., Gold Hill, Ore., has undergone a number of improvements since December 1 when the plant was closed for a two-months period for annual repairs. The large rotary kiln was relined and the grinding and quarry equipment all overhauled.

Orders of the company were filled during the two months shutdown from stores in the warehouse. The monthly shipments of cement by rail from this plant average about 200 cars, besides which large shipments are sent to southern Oregon and northern California by truck. Shipments of limestone to paper mills throughout the entire northwest are also made by the company.

B. D. Reynolds Heads Calcium Carbonate Corp.

B. D. REYNOLDS, Joplin, Mo., has been elected president of the recently formed Calcium Carbonate Corp. (Rock Products, February 1, 1930). Other officers include T. P. Black, Quincy, Ill., vice-president; E. H. Hermann, St. Louis, secretary, and H. E. Schellberg, Omaha, Neb., treasurer.

The Calcium Carbonate Corp. is the result of a merger of five different companies —Independent Gravel Co., Hannibal and Joplin, Mo.; Carthage Crushed Stone Co., Carthage, Mo.; Peerless White Lime Co., Genevieve, Mo.; Reliance Whiting Co., Alton, Ill.; Black White Limestone Co., Quincy, Ill., and the Western Limestone Products Co., Omaha, Neb.



Regional safety meeting, Portland Cement Association, Birmingham, Ala.

First of 1930 Cement Mill Safety Meetings Opens at Birmingham, Ala.

Attendance Larger Than at Any Previous Meeting

OPERATING departments of the southeastern cement mills within the membership of the Portland Cement Association were well represented at the annual safety meeting of that group, held in Hotel Tutwiler, Birmingham on January 22. The registered attendance of 127 was larger than for any of the previous meetings and the program an unusually comprehensive one, focusing clearly on safety and general personnel problems immediately ahead.

H. O. Underhill, superintendent of the Birmingham plant of the Alpha Portland Cement Company acted as general chairman and was assisted by the committee in charge, A. D. Stancliffe, general superintendent of the Lone Star plants in Alabama and Louisiana, and R. H. MacFetridge, superintendent of the Lehigh plant at Birmingham.

The attendance represented the Birmingham plant of the Alpha, the Cowan plant of the Cumberland, Birmingham plant of the Lehigh, Birmingham, Spocari and New Orleans plants and St. Stephen's quarries of the Lone Star, the Ragland plant of the National, Kingsport, Clinchfield and Richard City plants of the Pennsylvania-Dixie and the Leeds plant of the Universal Atlas Cement Co. There were also present a score of distinguished visitors.

Program

MORNING SESSION

Report on Safety Situation in the Cement Industry—A. J. R. Curtis, Secretary, Committee on Accident Prevention, Portland Cement Association.

"Safety, Now and Then"—Dr. James S. Thomas, director, Extension Division, University of Alabama.

"Benefits to Other Industries of Cement Plants Safety Work"—R. M. Thigpen, workmen's compensation clerk, State of Alabama.

"Safety and Cement"—S. F. Clabaugh, president, Protective Life Insurance Co., Birmingham.

LUNCHEON

Felix Guenther, Jr., general superintendent, Pennsylvania-Dixie Cement Corp., Kingsport, Tenn., presiding.

Address by T. G. Brobston, vice president, Birmingham Safety Council.

AFTERNOON SESSION

Quarry and Crushing Plant Accidents—C. H. Pickens, Pennsylvania-Dixie Cement Corp., Kingsport, Tenn.

Good Housekeeping as an Aid to Safety—W. W. Deadman, superintendent, Lone Star Cement Co., Spocari, Ala.

A Study of Fatal Accidents—D. M. Goss, safety director, Universal Atlas Cement Co., Leeds, Ala.

Safety in Packing and Shipping Departments—R. H. MacFetridge, superintendent, Lehigh Portland Cement Co., Birmingham.

First Aid Contest—Under the direction of F. C. Cash, district engineer, U. S. Bureau of Mines, assisted by C. E. Saxon, assistant engineer.

Teams entered—(Best score on 4 problems) Alpha Portland Cement Co., Birmingham, Ala.; Lehigh Portland Cement Co., Birmingham, Ala.; Lone Star Cement Co., Ala., Birmingham, Ala.; Pennsylvania-Dixie Cement Corp., Richard City, Tenn.

ANNUAL SAFETY DINNER

Toastmaster, R. H. MacFetridge.

Address, "Greetings"—Col. Henry A. Reninger, manager, department of safety and relief, Lehigh Portland Cement Co.

Address, "Roads and Prosperity"—John Temple Graves II, editor, *Birmingham Age Herald.*

Award of Trophy Cup to Winners of First Aid Contest—A. J. R. Curtis.

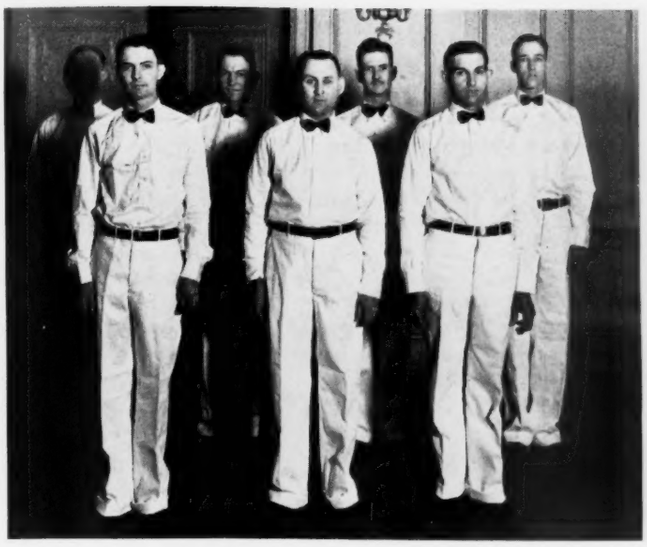
Entertainment.

Praises Cement Safety Work

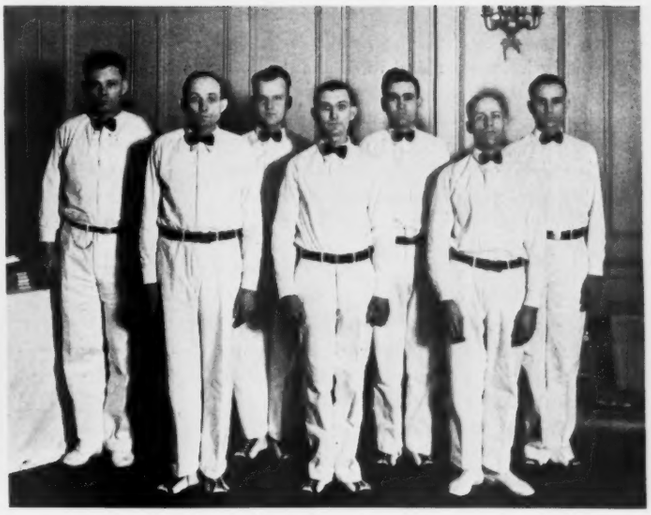
A very interesting address of Dr. James S. Thomas, director, Extension Division, University of Alabama, was given.

R. M. Thigpen, who since the war has been in charge of the Alabama state compensation department under his father, Commissioner George A. Thigpen, was very complimentary in his remarks relating to the safety work of the Alabama cement mills and effects on the work of other industries in that state. Mr. Thigpen said in part:

"Placing credit where credit is due, the Portland Cement Association started this general movement for plant safety in Alabama, for it was the inspiration of your remarkable experience that prompted our own safety work over the state as a whole. Half the cement plants in the state worked without loss of time due to accident during 1929 and the records of the others showed most hopeful reductions. I can see very



First aid team, Birmingham, Ala., plant, Alpha Portland Cement Co.—winners of trophy for highest score in competition



Second highest score was made by the first aid team of the Birmingham, Ala., plant of the Lehigh Portland Cement Co.

definitely that you are attacking carelessness in its last stand and closing in on the day of perfect records in all of your plants throughout the state. More power to you."

Mr. Clabaugh, president of one of the leading life insurance companies of the South, followed Mr. Thigpen with a complimentary reference to safety results in the cement mills, and exhorted the mill organizations to try for still better records during the years ahead.

Quarry and Crushing Plant Accidents

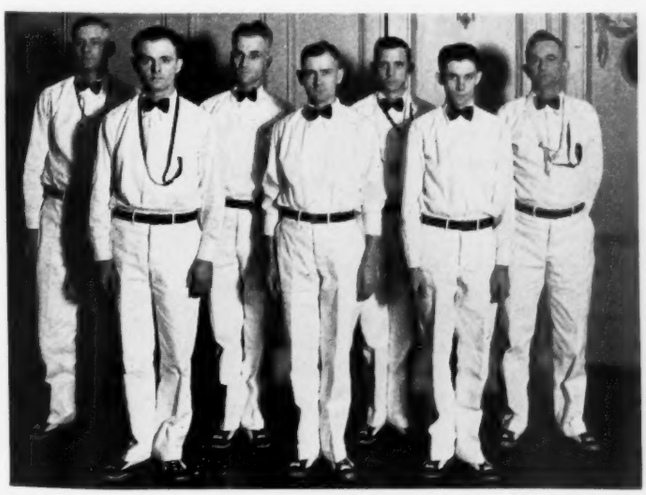
The afternoon session was given over entirely to discussions of specific mill safety problems and a competition by first aid teams representing four of the mills. In opening the discussion of quarry hazards, C. H. Pickens of the Pennsylvania-Dixie organization at Kingsport, Tennessee, said in part:

"Stripping of rocks, necessary in all but a few quarries, is not always considered one of the major operations, although it presents many opportunities for accidents. The top of the stone should be kept neat and orderly. Useless parts, old ties, etc., are a menace to the safety of the men.

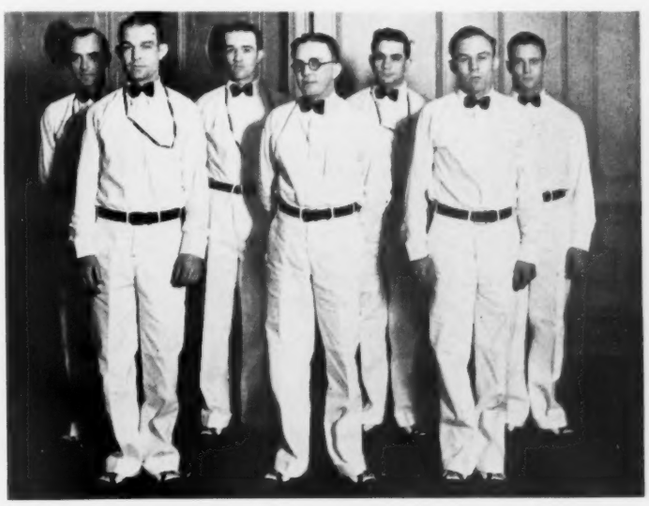
"Examination of equipment is most necessary. A broken strand of a cable, loose bolts and machinery, and other seemingly small defects are often the causes of wrecks that result in injuries. It is well to strip back a safe distance from the face of rock to be removed—otherwise loose rocks, or boulders may fall to the men working below. This will also tend to give confidence to the men removing rock on the quarry floor. Men scaling the face of rocks should be required to use life lines. Such lines should be inspected before being used. They should also be protected by a rubber hose slipped over the line as a safeguard against chafing or cutting through the line coming in contact with the sharp rocks.

"Drillers, like other employees of quarries, suffer injuries from accidents. Thinking of other things and temporarily letting the mind wander has resulted in accidents more than once. Gaging the height to raise the bit is an important part of the work. Raising it too high caused an accident whereby a foot was lost. Allowing too much slack after resting the bit on the floor caused one death, due to the bit swinging around and squeezing the operator. Careful examination of clutches especially, and all other parts of the drill is an important part in the prevention of accidents.

"Jack hammer drill operators work on the face of the rock or in the quarry proper and are subject to various hazards. Danger of injury from the drill itself is somewhat remote unless caused by bursting of hose or



First aid team of Richard City, Tenn., plant of the Pennsylvania-Dixie Cement Corp., won third place in the competition



Fourth place in the competition was won by the first aid team of the Birmingham plant of Lone Star Cement Co. Alabama

fittings on or near the drill. One serious hazard in this operation is the possibility of the bit breaking in the shank or stem. When this happens, the drill is apt to fall on the operator's foot. The operator should always have this in mind, especially when starting holes.

"The chief hazards of the work are those of sliding or screeping rocks above the men or the movement of rocks which they may be drilling. Loose rocks must be pulled down in advance of the operators' work. Secondary drillers should always stand facing the quarry face so that should any rocks slide down the face the driller will be more easily and quickly warned than if they stand with their backs or sides to the face of the quarry. Where there is danger of flying rocks or similar conditions, the use of goggles by the secondary drillers will prevent eye injuries. The clothing worn should be close fitting, particularly at the trouser bottoms. The use of "hard boiled" hats has also prevented many serious injuries to the head. The presence of drillers must always be kept in mind by the blasters. Unrelenting vigilance is necessary for their safety.

Hazard on Quarry Floor

"Reference is here made to those operations which comprise the care of the quarry floor proper. Loading of stone can be done neatly just as well as not, and when so done the quarry will present a safe place in which to work. Ridges of loose stone flying along loading tracks, old pipe, timbers and worn out machinery are a menace to the safety of workers. It costs little to remove these hazards and they should not be permitted at any time.

"There are quarries whose floors are as level as though they had been graded. High spots offer opportunities for stumbling. Holes are traps for men to fall into and sprain ankles. Accidents are recorded from both conditions.

"Recently several accidents have occurred around the front end of shovels. Operators of shovels will do well to bear in mind the safety of pit men and others. On the other hand the latter should be alert and take no chances. Shovels are somewhat human in their actions but they cannot warn us to keep away."

Good Housekeeping as Safety Aid

W. W. Deadman, superintendent of the Spocari, Ala., plant of the Lone Star Cement Co., Alabama, opened the discussion on "Good Housekeeping as an Aid to Safety" by reading a paper by that title prepared and contributed by the International Cement Corp. This paper, and others which followed were of an equally interesting nature and were the means of creating two hours of discussion on the more important phases of accident prevention work in the mills and quarries.

Following the discussion, F. E. Cash, district engineer of the U. S. Bureau of Mines and his assistants, Messrs. C. E. Saxon and N. L. Muir and A. H. Witt of the Mine Safety Appliance Co., conducted the first aid contest between the four teams chosen to represent their respective mills because of the excellence of their work.

The contestant teams occupied the center of the large convention hall of the Tutwiler hotel, with a hundred or more spectators arranged about them in a large oval. The contest revealed the excellence of the training, the work of all the teams being so good that it was difficult to distinguish the quality of one from that of another.

F. E. Cash

Results of the contest were anounced at the close of the dinner as follows:

First Aid Contest

Highest Score—winner of the member company cup, Alpha Portland Cement Co., Birmingham plant; score, 97¾. Personnel of the team was: Captain, M. H. Floyd; H. L. McLain, H. W. Busby, John Harrell, H. A. Smith, Daniel Stevens and Chester Boren.

Second Score—Lehigh Portland Cement Co., Birmingham plant; score, 96⅝. Captain, Newton Bagby; John McFarland, W. H. Jones, Joseph Rooker, William Ross, Hugh Kelly and Fred Addison.

Third Score—Pennsylvania-Dixie Cement Corp., Richard city plant; score, 95⅜. Captain, Tate O'Connor; Rob Knight, Ed Nobles, Otis Ake, Jerry Killian, Fred Grimes and Jim Palmer.

Fourth Score—Lone Star Cement Co., Alabama, Birmingham plant; score, 94⅞. Captain, Frank Lehner; L. K. Briley, J. J. Woodman, J. C. Alley, Logan Turner, P. W. Van Sandt and Edward Granmer.

REGISTRATION, REGIONAL SAFETY MEETING, BIRMINGHAM, ALA.,

Alpha Portland Cement Co., Birmingham, Ala.
B. H. Adams, plant chemist.
W. C. Boren, packing department.
J. C. Breann, pack house foreman.
G. C. Burgess, machinist.
H. W. Busbee, storekeeper.
J. H. Carter, carpenter.
W. L. Dandridge, chief clerk.
A. G. Darrough, bag house foreman.
M. H. Floyd, chief electrician.
J. L. Ford, night foreman.
John Franklin, quarryman.
J. B. Gable, blacksmith.
John M. Harnell, oiler.
C. F. Hesse, electrician.
H. P. Hunter, quarry foreman.
H. L. McLain, shipping clerk.
W. R. Morgan, electrician.
B. F. Nichols, well driller.
Joe W. Owen, physical tester.
C. E. Phillips, assistant superintendent.
Charles P. Postelle, southern sales manager.
Joe Price, repairman.
R. E. Scott, shovelman.
Homer Smith, yard foreman.
Daniel Stephens, yard.
F. E. Tuggle, chemist.
H. O. Underhill, superintendent.
R. L. Willis, repairman.

Cumberland Portland Cement Co., Cowan, Tenn.
Walter S. Ernst, chief chemist.
Frank Pearson, superintendent.

Florida Portland Cement Co., Tampa, Fla.
George D. Brown, general mill foreman.
E. E. Harris, superintendent mining department.

Lehigh Portland Cement Co., Birmingham, Ala.
Fred R. Addison, millwright.
Newton Bagly, blacksmith.
O. C. Browne, chief clerk.
O. W. Cunliff, master mechanic.
W. A. Craig, chief electrician.
R. E. Gudgen, timekeeper.
C. E. Harris, chemist.
W. H. Jones, coal miller.
Hugh Kelley, pump man.
J. H. McFarland, burner.
R. H. MacFetridge, superintendent.
John O'Brien, quarry superintendent.
Col. Henry A. Reninger, manager department of safety and welfare.
Joe F. Rooker, miller.
W. J. Ross, electrician.
H. E. Scoggins, pack house foreman.
Charles D. Scott, mill foreman.
C. F. Walters, bag house foreman.

Lone Star Cement Co. Alabama, Birmingham, Ala.
J. C. Alley, electrician.
R. W. Brake, foreman.
L. K. Briley, electrician.
W. M. Cabaniss, superintendent.
W. T. Dowdle, quarry foreman.
James H. Elliott, shipping clerk.
Eddie Grammar, millwright.
C. B. Hall, packing foreman.
J. W. Johnston, vice-president.
F. E. Lehner, machine shop foreman.
G. N. Pierce, chief electrician.
W. C. Powell.
A. W. Rabb, purchasing agent.
A. D. Stancliff, general superintendent.
D. M. Stoker, assistant chemist.
Logan Turner, bag tying.
P. W. Van Sandt, crane operator.
George F. Wiese, engineer.
George Winston, mill foreman.
J. J. Woodman, storekeeper.
H. M. Zimmerman, chief chemist.

Lone Star Cement Co. Alabama, Spocari, Ala.
W. W. Deadman, superintendent.
M. T. Forrester, shop foreman.
W. R. Foster, quarry foreman.
E. H. Glasscock, pack house foreman.
R. A. Grable, yard foreman.
Sam Hamnett, chief electrician.
C. M. Harper, quarry foreman.
W. T. Lambert, repairman.
H. C. McClessky, foreman.
J. Pearson, mill foreman.
Cecil Robinson, clerk.
E. L. Tarence, chemist.

Lone Star Cement Co. Louisiana, New Orleans
P. J. Boberg.
W. R. Foster, assistant quarry superintendent.
C. Jenkins, clerk.
D. V. Matthews.
Cecil Robinson.
N. Umphrey.

National Cement Co., Ragland, Ala.
J. P. Blankenship, Fuller mill operator.
C. T. Curd, mill foreman.
C. B. Davis, machinist.
E. O. Frampton, superintendent packing.
N. M. Greene, steam shovel man.
W. M. Norris, repairman.
Robert Reid Webb, safety engineer.

Pennsylvania-Dixie Cement Corp., Clinchfield, Ga.
F. H. Berul.
Norman V. Geyer.
David S. Marshall.
W. G. Riley.
J. M. Satterfield.

Pennsylvania-Dixie Cement Corp., Kingsport, Tenn.
C. H. Pickens.
F. Guenther, Jr.

Pennsylvania-Dixie Cement Corp., Richard City, Tenn.
Otis Ake, assistant shipping clerk.
J. F. Boyd, electrician.
Oscar Boyd, bag deparment.
E. W. Faris, burner.
Fred Grimes.
J. W. Killian, repairman.
R. M. Knight.
A. E. Legg, superintendent.
Walter Marshall.
Edd Nobles, machinist.
Tate O'Connor, draftsman.
C. L. Palmer, electrician.
Elwood Shaw, employment manager.
J. F. Uhlman, safety director.

Universal Atlas Cement Co., Leeds, Ala.
A. D. Elliott.
D. M. Goss, safety director.
B. E. Merrell, plant manager.

Miscellaneous
T. J. Brabston, vice-president, Birmingham Safety Council.
A. J. R. Curtis, Portland Cement Association.
F. E. Cash, U. S. Bureau of Mines.
N. L. Muir, U. S. Bureau of Mines, Jellico, Tenn.
Perkins J. Prewitt, director, Birmingham Safety Council.
C. E. Saxon, U. S. Bureau of Mines.
M. H. Small, Portland Cement Association.
R. M. Thigpen, workmen's compensation clerk, State of Alabama.

Texas Mills Meet to Push Safety

Annual Conference on Accident Prevention Is Successful

ALL NINE of the operating cement mills of Texas co-operated to make the regional safety meeting of the Portland Cement Association, held in Dallas on February 4, an unprecedented success. The attendance of 121 represented the mills of the Lone Star Cement Co. at Dallas and Houston, Republic Portland Cement Co. at San Antonio, San Antonio Portland Cement Co. at San Antonio, Southwestern Portland Cement Co. at El Paso, Trinity Portland Cement Co. at Dallas, Ft. Worth and Houston and Universal Atlas Cement Co. at Waco.

Lewis R. Ferguson, vice-president of the Lone Star Cement Co., Texas, acted as general chairman, C. E. Ulrickson presided at the luncheon and R. O. Bartholomew, chief engineer of the Trinity company, presided at the afternoon session.

Program

The program was as follows:

MORNING SESSION

"Safety Work in the Cement Industry During 1929," A. J. R. Curtis, Portland Cement Association.

"Good Housekeeping at the Plant," C. J. Lofstedt, superintendent, Lone Star Cement Co., Houston, Tex.

"Handling Explosives," H. K. Cameron, technical representative, E. I. DuPont de Nemours and Co.

AFTERNOON SESSION

"Hazards in the Packing House," A. E. Morris, warehouse foreman, Trinity Portland Cement Co., Ft. Worth.

"Increasing Efficiency of Plant Safety Programs," Dr. Charles E. Seale, plant physician, Lone Star Cement Co., Dallas.

"The Accident Report," Thomas E. Gibson, manager, Lumbermen's Reciprocal Association, Houston, Tex.

General discussion, led by R. J. Crampton, manager, Dallas Safety Council, followed by: J. W. Ganser, Trinity, Dallas; J. E. Bonnell, Lone Star, Dallas; C. A. Wallerstedt, superintendent, Universal Atlas Cement Co., Waco; A. E. Flowers, Jr., Trinity, Houston; A. A. Chaney, superintendent, Trinity, Ft. Worth; C. J. Lofstedt, Lone Star, Houston; A. L. Chase, Universal Atlas, Waco; T. E. Gibson, Houston; J. P. Frew, Lone Star, Houston; G. R. Harper, Lone Star, Dallas; Victor Fisher, Trinity, Dallas.

First Aid Demonstrations

Following the discussion there was an interesting and instructive exposition of first aid work conducted by Alexander U. Miller, mining engineer, U. S. Bureau of Mines. After reading a paper on the subject, Mr. Miller introduced the first aid teams of the Dallas and Ft. Forth plants of the Trinity Portland Cement Co., which were then called upon to demonstrate the entire list of test problems given to the teams which competed at the last International First Aid Competition. The personnel of the two teams is as follows:

Dallas plant, T. C. Pulley, captain; N. Duncan, J. Duncan, Frank Owens, L. O. Talkington, Samuel Taylor. Ft. Worth plant, H. Fleming, captain; G. A. Perry, R. E. Deilman, R. E. Galbraith, A. E. Morris, L. W. Winders.

The annual safety dinner was one of the enjoyable features of the meeting. Hon. Earle P. Adams of Austin, chairman of the State Industrial Accident Board, was the guest of honor and speaker of the evening. A three-act safety play was very ably given by the safety department of the Dallas Power and Light Co. Lewis R. Ferguson was toastmaster.

Quarry Hazards

The discussion of quarry hazards and safe quarry practices was opened with the paper by H. K. Cameron of the DuPont technical organization. Referring particularly to explosives hazards, Mr. Cameron presented a list of 49 "Don'ts" to be observed in the handling and use of dynamite and blasting powder; every case sent out by the DuPont and other explosives companies contains a copy of these precautions.

In the consideration of various phases of quarry work it was pointed out that the use of electricity introduced many new dangers requiring careful attention. Shovel equipment operated on 550-v. lines was referred to particularly. The recommendation was made that super-service cable be used and that to avoid the danger of dragging after the shovel it be supported on portable cross arms or tripods. It was pointed out that a clean and orderly quarry floor very greatly reduced the probabilities of falls and similar accidents and that the use of standard frogs and switches and the keeping of track in good repair are important factors in avoiding personal injury. Switch levers of a type operated at right angles with the track were recommended against, in favor of levers operating parallel with the rails.

Walkways were recommended for the side of all inclines and the practice of track walking discouraged. Good ballasting was held up as the preventative of many accidents to quarry train crews. The practice of loading cars too heavily, loading unevenly, op-

Annual dinner held in connection with the regional safety meeting at Dallas, Tex.

The "Hot Clinker" orchestra of the Lone Star Cement Co., Dallas plant

erating over rough track or heavy grades, defective brakes and weak couplings were all stressed as potential accident causes to be avoided.

Value of Industrial Physical Examination

A paper, "The Value of Industrial Physical Examination," by Thomas E. Gibson, was one of the features of the afternoon session. Mr. Gibson laid down the four fundamental principles of efficient accident prevention work that should prevail in every plant. **These are:**

1. There should be organized and operated by the key man of every plant a safety organization for the prevention of accidents, reducing cost and increasing production.

2. There should be a set of comprehensive plant operating rules and regulations, designed so as to not only assist in more efficient operation, but also to help in the elimination of accidents and the reduction of accident cost.

3. The interest of the individual worker must be obtained, which (in his opinion) can only be done through a no-accident campaign on a prize and competitive basis.

4. Physical examination in industry.

Physical Defects Contribute to Accidents

Mr. Gibson in discussing physical examination said in part:

"Investigation discloses that despite many precautions, all industrial accidents still cannot be eliminated due to the fact that certain physical defects contributed to or were responsible for many of the accidents. It has also been brought to light that a person having physical defects not only constitutes an accident hazard to himself, but he also increases the general accident hazard of his fellow workers. It has been established likewise, that the employe who has physical defects will produce from 10% to 25% less than the physically fit employe.

"Physical examination of the employe does not mean that because of every physical defect which may be discovered the employe is to be turned out or the prospective employe turned away to seek work elsewhere. In every case the employe should be placed where such physical defects could not contribute to the accident hazards for himself or others, or operate to slow down production. A slow thinking or slow moving person should never be made party to operations which might at times require him to think or move quickly.

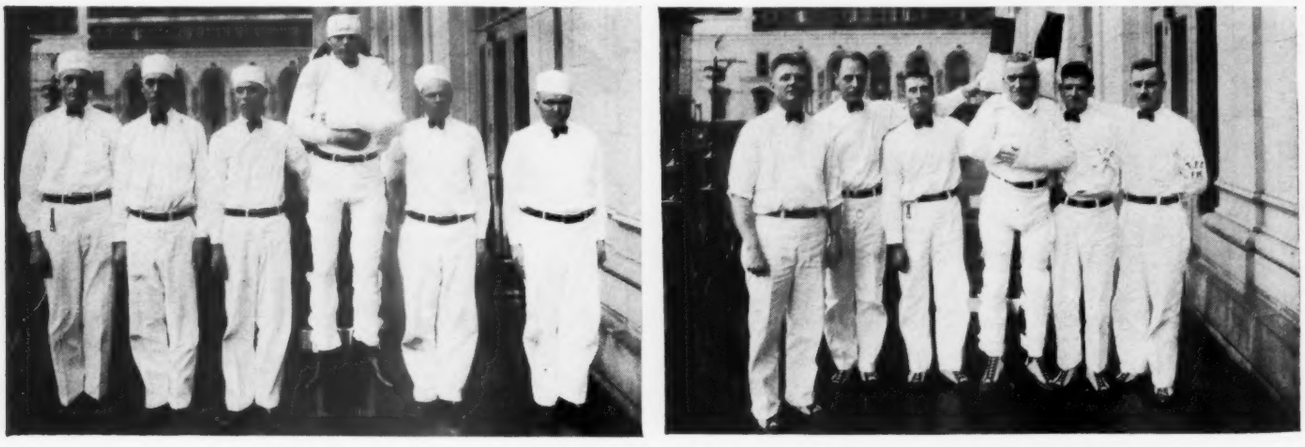
Weeding Out the Unfit

"When the safety movement was in an earlier stage, some of the larger plants in the eastern and northern parts of the country began to examine their applicants, turning down and weeding out the physically unfit. Within a few years the smaller plants were practically forced, for their own protection, to establish physical examination, as they began to get 40 to 50% more applicants for employment with physical defects than they did a few years prior. So at the present time practically all of the industrial establishments in that part of the country are examining all employes. So far as accident frequency, severity and cost is concerned, this trend has materially affected the southern states, and especially Texas, because many of the physically unfit or partly fit have drifted to this part of the country where they could obtain employment without any question as to the additional liability the employer assumes when he places men with physical defects on his payroll.

"Probably 20% of the employers of Texas, employing about 50% of the workers, have within the past several years established industrial physical examination as a part of their operating system, and it is only a matter of time when employers who are not now doing this will be forced to establish physical examination to protect themselves against the additional liability for which they are assuming by employing unfit persons.

Poor Eyesight a Hazard

"Defective eyesight causes about 25% of all industrial accidents and when you add this percentage to the accidents and cost involved through other physical defects such as large hernia rings, large varicose veins, high blood pressure, weak heart, epilepsy, venereal diseases, etc., you can readily understand that it is possible to have a percentage of from 30 to 50% of all accidents caused by physical defects of the workers."

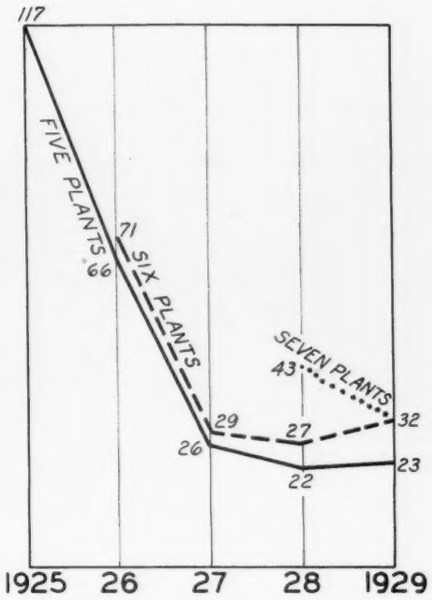


First aid teams of the Dallas (left) and Fort Worth plants, Trinity Portland Cement Co.

Accidents in the Texas Plants

The report read by A. J. R. Curtis disclosed some interesting figures on the trend of accidents in the cement mills and quarries of Texas. Mr. Curtis stated by way of comparison that whereas the 118 mills reporting to the Portland Cement Association in 1925 had suffered 2609 lost-time and fatal accidents, the 150 mills reporting in 1929 suffered only about 825 accidents. Thus over a period of five years there was a 27% increase in the number of mills and a 32% decrease in accident frequency.

Figures for the Texas mills were found similarly encouraging. The five mills which have reported each year during the last five years show a reduction from 117 to 23 accidents during that period. The seven mills operating in Texas during 1928 and 1929 showed a record of but 32 accidents in 1929. Two Texas mills had no lost-time or other recordable accidents during the latter year, while the average number of accidents per plant was 4.57 as against the average of 5.5 accidents for the country as a whole. However, three of the Texas plants showed records below the average for the country.



Accident frequency in Texas cement mills

Registration

REGISTRATION, DALLAS, TEXAS, REGIONAL SAFETY MEETING

International Cement Corp., New York City
H. R. Durbin, chief chemist.
Lone Star Cement Co., Kansas City, Mo.
J. A. Fairchild, chief chemist.
Lone Star Cement Co. Texas, Dallas, Tex.
E. L. Bennett, machinist.
A. C. Bietendorf, physical tester.
G. M. Bonnell, machinist.
J. E. Bonnell, superintendent.
H. A. Brennan, leader.
F. C. Burkhart, assistant chief chemist.
Owen Carter, driller.
George G. Casper, cost clerk.
J. T. Clunow, repairman.
J. W. Coppinger, carpenter foreman.
R. B. Curry, Jr., mill office.
H. E. Davis, quarry foreman.
S. B. Davis.
Lewis L. Dillon, chemist.
Lawton Edwards, laborer.
L. Evans, machinist.
S. C. Evans, repairman.
F. F. Fashing, warehouse foreman.
Lewis R. Ferguson, vice-president.
James R. Fester, construction.
J. H. Flora, electrician.
L. M. French, chief mill clerk.
J. P. Frew, construction foreman.
J. D. Ghan, sack sorter.
Zeph D. Graham, mill operator.
Robert Guess, sack house.
O. L. Hailey, chemist.
B. Hall, electrician.
A. W. Hamilton, electrician.
G. R. Harper, general mill foreman.
N. A. Henderson, time office.
Herbert Kelsay, assistant mill foreman.
E. R. Kirkham, electrician.
H. M. Krabbe, assistant superintendent.
W. Earl Mitchell, analyst.
N. A. Morchant, carpenter.
Clifford Nash, truck driver.
John Revel, repairman.
W. T. Ross, Jr., motor tender.
Riley Sanders, truck driver.
Dr. Charles Seale, plant physician.
Frank Smith, engineer.
G. T. Smith, shovel operator.
Joe Soltrich, sack counter.
J. H. Sparks, storekeeper.
T. B. Spears, carpenter.
W. R. Spears, carpenter.
C. J. Speich, plant engineer.
George Street, chemist.
H. L. Sutton, carpenter.
T. D. Thompson, miller.
James Thorp, electrician.
O. J. Tibbetts, night mill foreman.
Roy Wade, machinist helper.
Dr. Willar, repairman.
L. L. Wilson, repair foreman.
J. A. Wheeler, vice-president and treasurer.
Lone Star Cement Co. Texas, Houston, Tex.
B. F. Coffman, mill foreman.
F. F. Dearing, assistant chemist.
C. J. Lofstedt, superintendent.
H. O. Sutherland.
J. Z. Weaver, chief mill clerk.
Republic Portland Cement Co., San Antonio, Tex.
A. W. Dirk, packhouse foreman.
E. G. Spencer, assistant superintendent.
Trinity Portland Cement Co., Dallas, Tex.
R. O. Bartholomew, chief engineer.
Fred Buckett, civil engineer.
A. E. Carr, yard foreman.
S. A. Davidson, mill foreman.
D. D. Day, stock keeper.
J. L. Duncan, carpenter.
Newal Duncan, employer.
L. M. Fisher, quarry foreman.
V. K. Fischer, chemist.
J. W. Ganser, chief chemist.
F. S. Gattis, engineer.
Ben Hammond, mill foreman.
S. A. Helton.
J. J. Horgan.
Henry F. Lamb, general foreman.
W. C. McDowell, repairman.
G. M. Orr, timekeeper.
Frank Owen, repairman.
J. R. Poindexter, foreman.
T. C. Pulley, construction.
E. S. Rickens, foreman.
J. H. Snell.
J. D. Summers, chief engineer.
C. A. W. Sutherland, shop foreman.
L. O. Talkington, employe.
Sam A. Taylor.
C. E. Ulrickson, vice-president.
W. K. Williams, chemist.
R. C. Youngblood, general foreman.
Trinity Portland Cement Co., Fort Worth, Tex.
A. A. Chaney, superintendent.
R. E. Dielmann, chemist.
H. Fleming, chief electrician.
R. E. Galbraith, machine shop foreman.
A. E. Morris, foreman shipping department.
George A. Perry, repair foreman.
J. M. Simmons, plant cashier.
T. W. Smith, labor foreman.
B. W. Thompson, night foreman.
L. W. Winders, general foreman.
Trinity Portland Cement Co., Houston, Tex.
J. S. Cole, assistant chemist.
A. E. Flowers, Jr., plant chemist.
Universal Atlas Cement Co., Waco, Tex.
A. L. Chase, chief electrician.
C. A. Wallerstedt, plant manager.
Miscellaneous
H. K. Cameron, sales representative, E. I. du Pont de Nemours and Co., Dallas, Tex.
E. M. Cowpland, service representtive, Hercules Powder Co., Joplin, Mo.
C. J. Crampton, secretary, Dallas Chamber of Commerce, Dallas, Tex.
A. J. R. Curtis, Portland Cement Association.
Thomas E. Gibson, manager, engineering department, Lumbermen's Reciprocal Association, Houston, Tex.
F. C. Jones, salesman, Hercules Powder Co., Dallas, Tex.
M. W. Latimer, manager, Hercules Powder Co., Joplin, Mo.
W. B. Lenhart, associate editor, ROCK PRODUCTS, Chicago, Ill.
Alex U. Miller, associate mining engineer, U. S. Bureau of Mines, Vincennes, Ind.
A. L. Nixon, sales representative, E. I. du Pont de Nemours and Co., Dallas, Tex.
R. E. Price, safety engineer, Texas Employers Insurance Association, Dallas, Tex.
C. R. Sliger, safety engineer, Lumbermen's Reciprocal Association, Houston, Tex.

Rock Dusting Saves Lives in Mine Explosions

CONCRETE EVIDENCE that rock dusting saves lives in coal-mine explosions is contained in Information Circular No. 6178, just issued by the U. S. Bureau of Mines, on "Mine Explosions in the United States During the Fiscal Year Ending June 30, 1929," by D. Harrington and C. W. Awnings. The specific reference to rock dusting is as follows:

"Rock-dust has been applied to a limited extent in 13 of the 38 mines in which explosions occurred, and in 6 of these 13 mines there is no doubt that rock-dust played an important part in limiting the explosion. In these six mines 62 lives were lost, whereas 428 men were exposed to the explosions and many of them might have lost their lives if rock-dust had not been applied. In one mine rock-dust had been applied in the explosion area the night before the disaster occurred, and it undoubtedly stopped propagation of the flame; four men at the point of origin were killed, but there is very good reason for the belief that some or all of the other 58 lives were saved through the effectiveness of the rock-dusting. It is entirely probable that many of the 62 lives lost in the mines using rock-dust would have been saved if effective rock-dusting had been practiced. In most of these partly or imperfectly rock-dusted mines the explosion traveled through unprotected rooms, crosscuts or the trackless entries where only too many mining men think that rock-dusting is unnecessary. To be effective, rock-dust *must* be applied to *all* rooms, crosscuts, and entries to within at least 40 ft. of the face as well as to all other accessible open surfaces; the incombustible content must generally be 65% or more if no gas is present, with corresponding greater percentages of incombustible with increasing methane."

Stewart Sand to Handle Crushed Stone

ADDITION of crushed stone and stone products to its line of building materials is announced by the Stewart Sand and Material Co., Kansas City, Mo. This addition has been made possible through the leasing of substantially all the properties of the Consumers Material Corp. Extensive improvements are now being made at the various crushing plants which will greatly improve the quality of the materials and permit the full compliance with crushed stone specifications, the announcement states.

Great Lakes Portland to Add Grinding Unit at Cleveland Packing Plant

GREAT LAKES PORTLAND CEMENT CORP. has announced that facilities at its Cleveland, Ohio, packing plant are being enlarged to include a grinding mill with a capacity of 1000 bbl. a day. The Cleveland plant has heretofore been used exclusively for handling and sacking. It will be in operation by April, it is announced.

Instead of finished cement being shipped from the company's Buffalo, N. Y., plant to Cleveland for sacking, clinker will be sent there for grinding. Ample provision is being made in the new grinding unit for future expansion, it is said. Packing capacity of the plant is about 7000 bbl. a day.

The main plant of the Great Lakes company is in Buffalo.—*Cleveland* (Ohio) *Press.*

Detroit Firm May Buy Bruce Mines Quarry

NEGOTIATIONS are reported to be under way for the proposed sale of the trap rock quarry at Bruce Mines, Sault Ste. Marie, Ont., to the Port Crescent Sand and Fuel Co. of Detroit. This quarry has been in receivership since late summer, 1929. The Port Crescent company is one of the three sand and gravel companies which recently merged to form the Sand Products Corp., Detroit.—*Detroit* (Mich.) *Free Press.*

Develop Washington Quarry

OPTION to excavate rock from limestone formations on an 80-acre tract lying four miles southwest of Northport, Wash., has been granted Robert Orndorff and O. H. Schooler of Portland. Work of quarrying and shipping stone will be under way in early spring, the report states.

It was originally planned to erect a plant at Kane siding and tram rock down to a mill, but this has been given up for the present. The quarried rock will be loaded for shipment to other plants, where it will be utilized in the manufacture of fertilizers and paper.—*Spokane* (Wash.) *Chronicle.*

New Montreal Cement Plant Rumored

PLANS for the erection of a million dollar cement plant in Montreal, Can., are reported as being considered by prominent New York interests. Several sites, it is stated, have been tentatively mentioned, but from reports current there is every possibility that the plant will be erected in the north end of the city. The South shore is also favored by several in the group backing the project. St. Lambert has been freely mentioned as being the logical spot for such a project and, according to recent information representatives from New York made a tour of that district and seemed highly impressed with the location.

Montreal, however, seems assured of being the final place for the new plant, according to latest reports. The interests behind the project are said to be wealthy Swedish cement manufacturers who see the possibilities of big trade in Canada, if a proper plant is opened.

Faribault Stone Acquires Lieb Interests

THE Faribault Stone Co., Inc., recently formed, at a special meeting of the board of directors of the Lieb Stone Co., Inc., Faribault, Minn., has completed negotiations whereby it has taken over the assets of the Lieb company, which has been in existence since 1908. George Lieb acquired the property at that time and operated it as a quarry until 1919, when John J. Lieb took active charge of the management of the company and continued to operate it until 1929, when the Lieb Stone Co., Inc., was organized. It was announced also that Mr. Lieb has resigned as president of the firm, but will retain his financial interests in the new corporation. He has been engaged as operating manager of the quarry by the Faribault Stone Co. directors.

A new president and other officers will be chosen by the members of the board of directors at their next session. The present members of the board of directors are Joseph Burmeister, of the Faribault Oil Co.; H. A. Boyer, of the Boyer Cement Products Co.; George Redman; William R. Pearce; Fred J. Lemieux, Rubble Stone Co., Minneapolis, and John J. Lieb.

New equipment will be installed in the very near future at the quarry, and when this is ready for operation the new firm will be ready to handle several contracts.—*Faribault* (Minn.) *News.*

Canada Gypsum Changes Name

ONE of the long-established and better-known Canadian firm names disappeared with the announcement made recently by the president, R. E. Haire, that Canada Gypsum and Alabastine, Ltd., is henceforth Gypsum, Lime and Alabastine, Canada, Ltd. The new name was adopted as being more comprehensive and includes an important part of the company's activities, namely, lime. During the past year six lime companies were acquired and the present name gives a better understanding of the company's operations.

Sales of the company in December, 1929, showed a gain of 35% over those of the same month in the previous year, while for the full 12 months of 1929 sales are understood to have increased 36% over those of 1928. Export sales have shown similar increases, gains being 30% in excess of 1928.

Missouri Gravel Lands Bring $300 Per Acre

FORTY acres of gravel lands located south of Canton, Miss., were recently sold to the state of Missouri for the use of the state highway commission, at $300 an acre. This brings the state's purchases of land in the Mississippi bottom south of Canton, containing gravel deposits, to 230 acres, all at $300 per acre.—*Canton* (Miss.) *News.*

Western Gypsum Building Winnipeg Plant

WESTERN Gypsum Products, Ltd., has under construction a modern gypsum mill at Winnipeg, Man., where it has acquired a 23-acre site. A complete line of gypsum products will be made, including plaster, wallboard, partition and roof tile and other insulating materials. H. D. McLaughlin is president of the company. Associated with him are J. R. Spear, formerly of the Manitoba Gypsum Co. and British Columbia Gypsum Co., who is to be vice-president, and H. F. R. Baker, formerly general manager of the Manitoba Gypsum Co., Winnipeg. Mr. Baker will be production manager for the new company. The Western company's quarries are located at Amarauth, a short distance from Winnipeg.

Livermore Gravel Plant Has Good Safety Record

AN EXCELLENT safety record was achieved by the Kaiser Paving Co. in its gravel plant at Liverpool, Calif., during the year 1929, according to J. J. Rosedale, consulting safety engineer. There was not a single lost-time injury during the entire year. An average of 35 men were employed throughout the year and a total of 84,000 man-hours worked.

Safety work was done under the supervision of J. J. Rosedale, who, besides making inspections and having safeguards installed, has carried out an intensive campaign of education among the employes.—*Livermore* (Calif.) *Journal.*

Joins Powder Company

GEORGE S. EARNSHAW has been appointed central states sales representative of the Illinois Power Manufacturing Co., St. Louis, Mo.

Mr. Earnshow's association in the crushed stone and quarrying industries dates back over 30 years; hence he brings the Illinois company practical experience which should prove valuable in contacting and servicing.

Mr. Earnshaw is a brother of F. O. Earnshaw, president and general manager of the Carbon Limestone Co., Youngstown, Ohio, and the father of George M. Earnshaw, central representative of ROCK PRODUCTS. His headquarters are at 192 Hilton avenue, Youngstown.

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N. J.	.48	.48	1.15	1.25	1.40	.....
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75	.....	1.75	1.75
Buffalo, N. Y.	1.00	1.05	1.05	1.05	1.05	.....
Erie, Penn.	.75	.95	.....	.....	.....	.....
Milton, N. H.	.....	.....	1.75	.....	1.25	1.00
Montoursville, Penn.	1.00	.70	.50	.50	.50	.50
South Portland, Me.	.....	1.00	2.25	.....	.....	.....
Georgetown, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Appleton, Minn.	.....	.50	1.25	.....	1.50	.....
Attica, Ind.	.....	.....	All sizes .75–.85			
Barton, Wis.	.....	.40d	.50d	.60d	.60d	.60d
Beloit, Wis. (f)	.60	.30	.30	.40	.40	.40
Des Moines, Iowa	.40– .60	.60– .80	1.50–1.70	1.50–1.70	1.50–1.70	1.50–1.70
Dresden, Ohio	.....	.60– .70	.....	.70– .80	.70– .80	.....
Eau Claire, Wis.	.55	.55	.70	1.00	1.00	.....
Elkhart Lake and Glenbeulah, Wis.	.40	.40	.60	.60	.60	.60
Grand Rapids, Mich.	.50	.50	.80	.80	.80	.70
Hamilton, Ohio	.90-1.20	.90–1.20	.90–1.20	.90–1.20	.90–1.20	.90–1.20
Hersey, Mich.	.....	.50	.....	.50	.70	.70
Humboldt, Iowa	.40	.40	1.25	1.25	1.25	1.25
Indianapolis, Ind.	.50– .75	.40– .60	.50– .75	.50– .75	.60– .85	.60– .85
Kansas City, Mo.	.70	.70	.....	.....	.....	.....
Mankato, Minn.	.55	.45	.....	1.25	1.25	.....
Mason City, Iowa	.....	.40– .50	1.25	1.25	1.00–1.20	1.00–1.20
Milwaukee, Wis.	.91	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn.	.35	.35	1.25	1.25	1.25	1.25
St. Paul, Minn. (e)	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.	.....	.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.10	1.00	1.00
SOUTHERN:						
Brewster, Fla.	.40	.40	.....	.....	.....	.....
Charleston, W. Va.	.70	1.25	1.25	.....	.....	.....
Eustis, Fla.	.....	.40– .50	.....	.....	.....	.....
Fort Worth, Texas	.75	.75	.90	1.00	1.00	1.10
Knoxville, Tenn.	.70–1.00	1.20	.....	.....	1.20	1.20
Roseland, La.	.30	.30	.80	.80	.80	.....
WESTERN:						
Los Angeles, Calif.	.10– .40	.10– .40	.20– .90	.50– .90	.50– .90	.50– .90
Oregon City, Ore.	.....	All grades range from 1.00 to 1.50 per cu. yd.				
Phoenix, Ariz. (c)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.70	.60	.....	.....	1.20	1.15
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*	1.00*	1.00*

*Cu. yd. ‡Delivered on job by truck. (c) 60-70% crusher boulders. (d) Plus 15c for winter loading. (e) Prices f.o.b. N. P. Ry. (f) Algonquin, Ill., district, 5c per ton higher.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.75	2.75	2.75	.....	.....	3.75	.....
Cheshire, Mass.	Sand for soap, 7.00–8.00					6.00–8.00	.....
Dresden, Ohio	1.50–1.75	1.25–1.50	1.50	.....	1.50	.....	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.50–3.00	.....
Elco, Ill.	Soft amorphous silica, 92%–99% thru 325 mesh, 18.00–40.00 per ton						
Franklin, Penn.	1.75	1.75	.....	.....	.....	.....	.....
Kasota, Minn.	.....	.....	.....	.....	.....	.....	1.00
Montoursville, Penn.	.....	.....	.....	1.35–1.50	.....	.....	.....
New Lexington, Ohio	2.25	2.00	.....	.....	.....	.....	.....
Ohlton, Ohio	1.75	1.75	.....	2.00	1.75	1.75	.....
Ottawa, Ill.	1.25–3.25	2.25–3.50	1.25–3.25	1.25–3.25	1.25	3.50	3.50
Red Wing, Minn. (a)	.....	.....	.....	.....	1.50	3.00	1.50
San Francisco, Calif.	3.50†	5.00†	3.50†	2.50–3.50†	5.00†	3.50–5.00†	.....
Silica, Mendota, Va.	Potters' flint, 8.00–14.00						

†Fresh water washed, steam dried. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	.....	1.50
Eau Claire, Wis.	4.30	1.00
Franklin, Penn.	.....	1.75
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	1.25–3.25	1.25
Red Wing, Minn.	.....	1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.	.....	1.75

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. plant.

Cheshire, Mass., in carload lots	5.00–7.00
Franklin, Penn.	2.25
Klondike, Mo.	2.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	2.50–3.00

Bank Run Sand and Gravel

Prices given are per ton, f.o.b. producing plant or nearest shipping point.

Appleton, Minn.†	.55
Beloit, Wis.¶ (½-in. and less)	.30
Brewster, Fla.†	.40
Burnside, Conn. (sand, ¼-in. and less)	.75*
Chicago, Ill.†	.92–1.20
Des Moines, Ia. (sand and gravel mix).	.60–1.05
Fort Worth, Tex.¶ (2-in. and less)	.70
Gainesville, Tex.¶ (1½-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less)	.55
Hamilton, Ohio¶ (1½-in. and less)	.50–1.00
Hersey, Mich.¶ (1-in. and less)	.50
Mankato, Minn.†	.70
Pueblo, Colo.—†River run sand	.50
Seattle, Wash.—Sand, 1/10-in. down, .25*; ¼-in. and less, same; gravel in sizes ranging from 2-in. and less to ½-in. and less	.25*
Winona, Minn.†	.60
York, Penn. Sand, ¼-in. and less, 1.00; 1/10-in. down	1.10

*Cubic yard. †Fine sand, 1/-10-in. down. (a) Cu. yd., delivered Chicago. ¶Gravel.

Current Price Quotations

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Portland Cement

	Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.91¼	3.05	4.30¶
Atlanta, Ga.	.....	1.99	*3.49¶
Baltimore, Md.	.....	2.26	3.40¶
Berkeley, Calif.	.....	2.14	.....
Birmingham, Ala.	.....	1.65	*3.15¶
Boston, Mass.	.57	1.78–1.88	3.27¶
Buffalo, N. Y.	.61¼	1.95–2.05	3.35¶
Butte, Mont.	.90¼	3.61	.....
Cedar Rapids, Ia.	.....	2.16–2.23	2.99f
Centerville, Calif.	.....	2.14	.....
Charleston, S. C.	.....	2.09a	*3.26¶
Cheyenne, Wyo.	.71½	2.26	.....
Chicago, Ill.	.....	1.95	3.15¶
Cincinnati, Ohio	.....	1.92–2.14	3.22¶
Cleveland, Ohio	.....	1.94–2.04	3.24¶
Columbus, Ohio	.....	1.92	3.22¶
Dallas, Texas	.....	1.65	3.14¶
Davenport, Iowa	.....	2.04–2.14	.....
Dayton, Ohio	.....	1.84–1.94	3.24¶
Denver, Colo.	.63¾	2.55	.....
Des Moines, Iowa	.48½	1.94	2.99f
Detroit, Mich.	.....	1.95	3.25¶
Duluth, Minn.	.....	2.04	.....
Fresno, Calif.	.....	2.33	.....
Houston, Texas	.....	1.75	3.38¶
Indianapolis, Ind.	.54¾	1.89–1.99	f3.19–3.19¶
Jackson, Miss.	.....	2.09–2.29	*3.59¶
Jacksonville, Fla.	.....	2.14b	*3.26¶
Jersey City, N. J.	.....	2.13	3.28¶
Kansas City, Mo.	.48	1.92	f3.22–3.07¶
Los Angeles, Calif.	.37½	1.50	.....
Louisville, Ky.	.55½	1.91	f2.92–3.31¶
Memphis, Tenn.	.....	2.05–2.29	f3.55–*3.55¶
Merced, Calif.	.....	2.01	.....
Milwaukee, Wis.	.....	1.90–2.10	3.30
Minneapolis, Minn.	.....	2.27	.....
Montreal, Que.	.....	1.60	.....
New Orleans, La.	.43	1.82	3.22¶
New York, N. Y.	.60¼	1.93–2.03	3.33¶
Norfolk, Va.	.....	1.87–1.97	3.27¶
Oklahoma City, Okla.	.54	2.36	3.51¶
Omaha, Neb.	.50¼	2.22	3.37¶
Peoria, Ill.	.....	2.12	3.32¶
Pittsburgh, Penn.	.....	1.95	3.01¶
Philadelphia, Penn.	.....	2.15	3.30¶
Phoenix, Ariz.	.....	3.51	.....
Portland, Ore.	.....	2.30–2.40	.....
Reno, Nev.	.....	2.86	.....
Richmond, Va.	.....	2.16–2.32	3.56¶
Sacramento, Calif.	.....	2.25	.....
Salt Lake City, Utah	.70¼	2.81	.....
San Antonio, Texas.	.....	.....	3.42¶
San Francisco, Calif.	.....	2.14	.....
Santa Cruz, Calif.	.....	2.10	.....
Savannah, Ga.	.....	2.09a	*3.16¶
St. Louis, Mo.	.48¾	1.60–1.70	f3.00–3.00¶
St. Paul, Minn.	.....	2.27	.....
Seattle, Wash.	.....	2.40	f3.70
Tampa, Fla.	.....	1.80	*3.41¶
Toledo, Ohio	.....	2.03–2.20	3.33¶
Topeka, Kan.	.50¼	2.11	3.26¶
Tulsa, Okla.	.50¾	2.23	3.38¶
Wheeling, W. Va.	.....	1.92–2.02	3.07¶
Winston-Salem, N. C.	.....	2.14	3.54¶

Mill prices f.o.b. in carload lots, without bags, to contractors.

Albany, N. Y.	2.15	.....
Bellingham, Wash.	2.25	.....
Buffington, Ind.	1.70	.....
Chattanooga, Tenn.	2.05	.....
Concrete, Wash.	2.35	.....
Davenport, Calif.	2.05	.....
Hannibal, Mo.	1.90	.....
Hudson, N. Y.	1.75	.....
Leeds, Ala.	1.65	.....
Lime & Oswego, Ore.	2.40	.....
Mildred, Kan.	2.35	.....
Nazareth, Penn.	2.15	.....
Northampton, Penn.	1.75	.....
Richard City, Tenn.	2.05	.....
Steelton, Minn.	1.85	.....
Toledo, Ohio	2.20	.....
Universal, Penn.	1.70	.....

NOTE: With exception of prices for "Incor" and "Velo" cement, prices quoted are net prices, without charge for bags, and all discounts deducted. Add 40c per bbl. for bags. (a) 44c refund for paid freight bill. (b) 38c bbl. refund for paid freight bill. (f) "Velo" cement, including cost of paper bag, 10c disc. 10 days. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c disc. 15 days. *Subject 25c bbl. dealer discount.

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chazy, N. Y.	.75	1.60	1.60	1.30	1.30	1.30
Farmington, Conn.	.....	1.30	1.10	1.00	1.00	.....
Ft. Spring, W. Va.	.35	1.35	1.35	1.25	1.15	1.15
Munns, N. Y.	.75	1.15	1.15	1.00	1.00	.....
Oriskany Falls, N. Y.	1.00	1.25	1.25	1.25	1.25	1.25
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
Shaw's Junction, Penn. (e)	.85	1.20–1.35	1.20–1.35	1.20–1.35	1.40	1.30–1.35
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill. (b)	1.85	.....	1.85	.....	.....	.....
Cypress, Ill.	1.15	1.10	1.00	1.15	1.15	1.20
Davenport, Iowa	1.00	1.50	1.50	1.30	1.30	1.30
Dubuque, Iowa	1.00	1.10	1.10	1.00	1.00	.....
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05–1.70	1.05–1.70	.....
Greencastle, Ind.	1.25	1.00	1.00	1.00	1.00	1.00
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
McCook, Ill.	.90	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.75–1.00	1.65–1.85	1.45	1.15	1.05	.95
Sheboygan, Wis.	1.00	1.00	1.00	1.00	.....	.....
Stone City, Iowa	.75	.....	1.10	1.00	1.00	1.00h
Toronto, Canada (i)	2.70	2.70	2.50	2.50	2.50	2.50
Waukesha, Wis.	.....	.90	.....	.90	.90	.....
Wisconsin points	.50	.....	.100	.90	.90	.....
Youngstown, Ohio	1.00	1.00	1.25	1.25	1.25	1.25
SOUTHERN:						
Cartersville, Ga.	1.00	1.65	1.65	1.35	1.15	1.15
Chico and Bridgeport, Texas	1.00–1.35	1.10–1.30	1.10–1.25	1.25	1.00–1.20	1.00
Cutler, Fla.	.50– .75r	.....	.....	1.75r	.....	1.10g
El Paso, Texas	.50	1.25	1.25	1.00	1.00	1.00
Olive Hill, Ky.	1.00	1.00	1.00	.90	.90	.90
Rocky Point, Va.	.50– .75	1.40–1.60	1.30–1.40	1.15–1.25	1.10–1.20	1.00–1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	.25	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.10	1.25	1.25	1.25	1.00	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Rock Hill, St. Louis, Mo.	1.45	1.45	1.45	1.45	1.45	1.45
Stringtown, Okla.	1.00–1.35	1.10–1.30	1.10–1.25	1.25	1.00–1.20	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Chico, Texas	2.50	2.00	1.45	1.20	1.15	.....
Duluth, Minn.	.90–1.25	2.25–2.75	1.55	1.55	1.55	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.45	1.25	1.20	1.15
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.55	2.30	2.10	1.70	1.70	.....
Richmond, Calif.	.70	.....	1.00	1.00	1.00	.....
Toronto, Canada (i)	4.70	5.80	.....	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite	.50	.....	1.75	1.75	1.60	.....
Chicago, Ill.—Granite	2.00	1.70	.....	1.50	1.50	.....
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock	.....	.....	2.25–2.50s	.....	.....	.....
Lithonia, Ga.—Granite	.75	1.50	1.35	1.25	1.15	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00–3.50	.....	2.00–2.25	2.00–2.25	.....	1.25–3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Toccoa, Ga.—Granite	.50	1.35	1.35	1.25	1.25	1.20

(a) Limestone, ¼ to ⅜ in., 1.35 per ton; Lime flour, 8.50 per ton. (b) Wagonloads. (c) 1 in., 1.40. (d) 2-in., 1.30. (e) Price net after 10c discount deducted. (g) Per cu. yd., 3-in. and less. (h) Rip rap. (i) Plus 25c per ton for winter delivery. (n) Ballast, R.R., .90; run of crusher, 1.00. (q) Crusher run, 1.40; ¼-in. granlithic finish, 3.00. (r) Cu. yd. (s) 1-in. and less, per cu. yd. (t) Rip rap, 1.20–1.40 per ton.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Allentown, Penn.	1.00–1.50	.40– .60	.80–1.00	.50– .80	.50– .80	.60– .80	.80
Bethlehem, Penn. (a)	1.25–1.75	.50– .70	.....	.60– .80	.70– .80	.60– .90	.80
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Hokendauqua, Penn.	1.25–1.75	.60	.90	.60– .90	.60– .90	.60– .90	.....
Reading, Penn.	2.00	1.00	.....	1.00	.....	.....	.....
Swedeland, Penn.	1.50–2.50	.60–1.10	1.00–1.25	.90–1.25	.90–1.25	1.25	1.25
Western Pennsylvania	2.00	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	.....
Jackson, Ohio	2.05*	1.05*	1.80*	1.30*	1.05*	1.30*	.....
Toledo, Ohio	1.50	1.10	1.25	1.25	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	.....
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.90
Longdale, Va.	2.50	.75	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*	.....	1.15*	.90*	.90*	.....

5c per ton discount on terms. †1¼ in. to ¼ in., 1.05; ⅝ in. to 10 mesh, 1.25*; ⅝ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*. (a) Unwashed, 1.00–1.25.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 98% $CaCO_3$; 0% $MgCO_3$; 100% thru 4 mesh 1.85

Belfast, Me.—Analysis, $CaCO_3$, 90.4%; $MgCO_3$, trace; 90% thru 100 mesh, per ton 10.00

Branchton, Penn.—94.89% $CaCO_3$; 1.50% $MgCO_3$, 100% thru 20 mesh; 80% thru 80 mesh and 60% thru 100 mesh.. 3.50–5.00

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh 1.50

Cartersville, Ga.—90% thru 100 mesh, 2.00; 50% thru 50 mesh..... 1.50

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton 6.00

Joliet, Ill.—Analysis, 52% $CaCO_3$; 48% $MgCO_3$; 90% thru 100 mesh..... 3.50

Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk 2.50

Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton 2.00

Marlbrook, Va.—(Lime marl)—Analysis, $CaCO_3$, 90%; 90% thru 100 mesh, in bags, 3.50–4.00; bulk 2.00–2.25

Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh 4.50

Agricultural Limestone

(Crushed)

Atlas, Ky.—Analysis, $CaCO_3$, 94-98%; $MgCO_3$, trace; 90% thru 4 mesh 1.00

Bedford, Ind.—Analysis, 98½% $CaCO_3$; ½% $MgCO_3$; 90% thru 10 mesh; 30% thru 100 mesh 1.50

Chico and Bridgeport, Texas—Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 90% thru 4 mesh 1.00

Charles-Town, W. Va.—Lime Marl—Analysis, 95% $CaCO_3$, 50% thru 100 mesh, bulk, 3.00; including burlap bags 4.50

Colton, Calif.—100% thru 14 mesh, bulk 3.50

Cypress, Ill.—Analysis, 96% $CaCO_3$; 90% thru 100 mesh, 1.35; 50% thru 100 mesh, 1.25; 90% thru 50 mesh, 1.20; 50% thru 50 mesh, 90% thru 4 mesh and 50% thru 4 mesh, all 1.10

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton 1.10

Dubuque, Ia.—Analysis, 34.96% $CaCO_3$; 59.62% $MgCO_3$; 90% thru 4 mesh..... .95

Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh..... 1.00

Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh 1.15

Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh, sacked 5.00

Jamesville, N. Y.—Analysis, 90% $CaCO_3$; 5% $MgCO_3$; 90% thru 100 mesh; in sacks, 4.60; bulk 3.35

Lannon, Wis. — Analysis, 54% $CaCO_3$ 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00

Screenings (¼ in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh.... 3.00

90% thru 50 mesh 2.00

90% thru 4 mesh 1.00

McCook and Gary, Ill.—Analysis, 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh ..... .90

Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Kokomo, Ind. —85% thru 10 mesh, 25% thru 100 mesh 1.50

Rocky Point, Va.—50% thru 200 mesh, bulk, in carloads, 2.00; 100-lb. paper bags, 3.25; 200-lb. burlap bags..... 3.50

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.15–1.70

Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh..... .75

West Stockbridge, Mass.* — Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk 3.50

100-lb. paper bags, 4.75; 100-lb., cloth 5.25

Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh..... 2.10

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton 6.00

Hillsville, Penn., sacks, 5.10; bulk..... 3.50

Joliet, Ill.—Analysis, 50% $CaCO_3$; 42% $MgCO_3$; 95% thru 100 mesh (bags extra) 3.50

Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50

Waukesha, Wis. — 90% thru 100 mesh, bulk 4.00

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.	.....	.....	12.00	.....	.....	17.50	.....	2.00
Buffalo, N. Y.	.....	.....	.....	12.00	.....	.....	.....	.....
Knickerbocker, Devault, Cedar Hollow and Rambo, Penn.*	.....	9.50	9.50	9.50	.....	9.50	8.50	.....
Lime Ridge, Penn.	9.00	9.00	9.00	.....	7.00	.....	5.00	.....
CENTRAL:								
Afton, Mich.	.....	.....	.....	.....	.....	10.75	7.50	12.11
Carey, Ohio	9.50	6.50	6.50	.....	8.00	.....	8.00	1.50
Cold Springs, Ohio	.....	7.75	7.75	.....	7.00	9.00	7.00	.....
Gibsonburg, Ohio	10.50	.....	7.75	.....	7.00	9.00	7.00	.....
Huntington, Ind.	.....	6.50	6.50	.....	.....	.....	.....	.....
Little Rock, Ark.	.....	14.40	.....	14.40	.....	.....	11.90	1.79
Marblehead, Ohio	.....	6.50	6.50	.....	.....	.....	7.00	1.50[3]
Milltown, Ind.	.....	7.50– 8.50	.....	8.25– 9.25	7.00[5]	9.25[6]	6.50[7]	1.40[8]
Scioto, Ohio	.....	7.00	7.00	8.00	.....	.62½	6.50	1.50
Sheboygan, Wis.	.....	10.50	10.50	10.50	.....	.....	9.50	2.00[4]
Tiffin, Ohio	.....	.....	.....	.....	8.00	10.00	.....	.....
Wisconsin points	.....	11.50	.....	.....	.....	.....	9.50	.....
Woodville, Ohio	10.50	7.75	7.75	11.50[24]	7.00	9.00[9]	7.00	1.50[3]
SOUTHERN:								
Keystone, Ala.	17.00	9.00	9.00	8.00–12.00	.....	.....	6.00[21]	1.35
Knoxville, Tenn.	.....	9.00	9.00	9.00	.....	.....	8.00	.....
Ocala, Fla.	12.00	10.00	10.00	12.00	.....	.....	.....	1.40
Pine Hill, Ky.	.....	9.00	9.00	9.00	.....	.....	8.00	.....
WESTERN:								
Kirtland, N. M.	.....	.....	.....	.....	.....	.....	15.00‡	.....
Los Angeles, Calif.	.....	.....	.....	.....	.....	.....	12.00	.....
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[20]	.90[17]	11.00[19]	1.85[17]
San Francisco, Calif.†	20.00	16.00	12.00	20.00	16.00	.....	16.00	1.95

[1]Also 6.00. [2]To 1.35. [3]Wooden, steel, 1.60. [4]Steel. [5]To 7.50. [6]To 9.75. [7]To 7.00. [8]To 1.50 in steel drums; 1.25 and 1.35 in waterproof bags. [9]In 80-lb. paper. [10]Per bbl. [17]Less credit for return of empties. [19]To 14.50. [20]Also 13.00. [21]To 8.00. [24]Superfine, 92.25% thru 200 mesh. *Price to dealers. †Wood-burnt lime. ‡Also 12.00.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Penn Argyl, Penn.—Screened, all thru 200 mesh, 7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton.
Granville, N. Y.—Red, green and black, $7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.00 per ton in bulk; 6.50 in 150-lb. burlap bags, plus 10c per bag.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—Buckingham oxford grey	13.88	17.22	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.50–14.50	24.50	29.00	33.50	44.50	55.60
No. 1 ribbon	9.00–10.25	20.00	24.50	29.00	40.00	51.25
Gen. Bangor No. 2 ribbon	6.75– 7.25	.....	.....	.....	.....	.....
Gen. Bangor mediums	9.50–11.25	.....	.....	.....	.....	.....
No. 1 Albion clear	9.00–10.50	16.00	23.00	27.00	37.00	46.00
Chapman Quarries, Penn.—No. 1	8.50–11.25		(Vari-tone, 12.00–13.00)			
Medium	7.75– 9.00	.....	.....	.....	.....	.....
Hard vein	.....	16.00	23.00	26.00	32.00	40.00
Granville, N. Y.—Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green and gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00	.....	.....	.....	.....
Pen Argyl, Penn.*						
Graduated slate (blue)	.....	16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)	.....	18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8.25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 14.00–15.00; 10% disc. to roofer; 10%–8⅓% to wholesaler.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:	
Crude talc, per ton	5.00
Ground talc (20-50 mesh), bags	6.50
Ground talc (150-200 mesh), bags	9.00
Pencils and steel crayons, gross	1.50– 2.00
Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh	7.50– 8.00
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of bags. Terms 1%, 10 days.	
Clifton, Va.:	
Crude talc, per ton	4.00
Ground talc (150-200 mesh), in bags	12.00
Conowingo, Md.:	
Crude talc, bulk	4.00
Ground talc (150-200 mesh), in bags	14.00
Cubes, blanks, per lb.	.10
Emeryville, N. Y.:	
Ground Talc (200 mesh), bags	13.75
Ground talc (325 mesh), bags	14.75
Hailesboro, N. Y.:	
Ground talc (300-350 mesh) in 200-lb. bags	15.50–20.00
Henry, Va:.	
Crude (mine run)	3.50– 4.50
Ground talc (150-200 mesh), bags	6.25–14.00
Joliet, Ill.:	
Ground talc (200 mesh) in bags:	
California white	30.00
Southern white	20.00
Illinois talc	10.00
Los Angeles, Calif.:	
Ground talc (150-200 mesh) in bags	16.00–25.00
Natural Bridge, N. Y.:	
Ground talc (325 mesh), bags	10.00–15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-72%....	3.75– 4.25
Mt. Pleasant, Tenn.—B.P.L. 75%	6.25
Run of plant fines, 72% B.P.L., per ton of 2000 lb.	5.00

Ground Rock

(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65–70%....	3.75– 4.25
Mt. Pleasant, Tenn. — Lime phosphate:	
B.P.L. 73%	11.80
Mt. Pleasant, Tenn.—B.P.L., 72%	5.00– 5.50

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Florida—F.o.b. mines, gross ton, 68/66% B.P.L., Basis 69%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	100.00–125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, Bristol and Cardigan, N. H.—Per ton:	
Mine scrap	22.50
Mine run (plate)	280.00
Clean shop scrap	27.50
Roofing mica	42.00
Punch mica	160.00
Trimmed mica, per ton, 20 mesh, 42.00; 40 mesh, 45.00; 100 mesh, 60.00; 200 mesh	75.00
Trenton, N. J.—Mine scrap, per ton	20.00

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa	.....	.....	6.00	7.00	.....	7.50	8.50	10.50a	.....	.....	.....	.....	.....
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton, floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 3 in. long, 17c per ft., 23.00 per ton.													
Fort Dodge, Iowa	2.50	6.00	6.00	7.00	9.00	9.00	11.50	8.00	16.00	20.00	15.00	.....	25.00
Grand Rapids, Mich.	.....	.....	.....	.....	9.00d	9.00d	.....	8.00d	.....	21.00d	.....	15.00	25.00
Los Angeles, Calif. (b)	.....	7.00–9.00	7.00–9.00	7.50–9.00	8.00–10.00	.....	8.00–10.00	.....	30.00c	.....	.....	.....	.....
Medicine Lodge, Kan.	1.40	.....	.....	.....	.....	.....	11.50d	.....	16.00d	11.50d	.....	.....	.....
Portland, Colo.	.....	7.00	7.00	9.00	9.00	9.50	9.00	.....	27.50	.....	22.50	27.50	.....
Providence, R. I. (x)	.....	.....	.....	12.00–13.00e	.....	.....	.....	.....	.....	.....	.....	.....	.....
Seattle, Wash. (z)	6.00	9.00	9.00	13.00	.....	.....	14.00	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00g	33.00f

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, ¼x32x36-in., 14c-17c per sq. ft.; ⅜x32x36-in., 15c-18c per sq. ft. (c) To 40.00. (d) Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (g) ⅜x48-by 3 to 4 ft. long. (x) "Fabricaste" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plant, 7¼c-8¼c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft., 4-in., 11c per sq. ft.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags, bulk, per ton		7.50
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, per ton	‖6.00	‖6.00
Easton, Penn.—Royal Green	16.00–20.00a	
Harrisonburg, Va.	11.00–14.50	
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt.—Middlebury white		¶9.00–‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		c5.50
Phillipsburg, N. J.—Royal green granite		15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Stockton, Calif.—"Nat-rock" roofing grits		12.00–40.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		8.00–15.00

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb. (c) Per ton f.o.b. quarry in carloads; 7.00 per ton L.C.L.

Soda Feldspar

De Kalb Jct., N. Y.—Color, white; pulverized (bags extra, burlap 2.00 per ton, paper 1.20 per ton); 99% thru 140 mesh, 16.00; 99% thru 200 mesh, per ton 18.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140 mesh (bulk) 19.00

Keystone, S. D.—Color, white; analysis, K_2O, 13.50%; Na_2O, 2.25%; SiO_2, 64.10%; Fe_2O_3, .03%; Al_2O_3, 20.10%, pulverized 99% thru 200 mesh, in bags, 17.00; bulk 16.00
Crude, in bags, 9.50; bulk 8.50

Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton 8.00

Erwin, Tenn.—White; analysis, K_2O, 12%; Na_2O, 3.5%; SiO_2, 68%; Fe_2O_3, .07%; Al_2O_3, 18.5% pulverized, 95% thru 325 mesh, in bags, 15.00–17.50; bulk, 15.00–17.00; crude feldspar, bulk 9.00

Trenton, N. J.—White; analysis, K_2O, 13-14%; Na_2O, 2-2½%; SiO_2, 64-65%; Fe_2O_3, 0.07; Al_2O_3, 18.50-19.25%; pulverized, 97% thru 325 mesh, crude, 8.50 per ton, ground 21.00

Rumney and Cardigan, N. H. — Color, white; analysis, K_2O, 9-12%! Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk 7.00– 7.50

Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk 7.00– 7.50

Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk 18.00
(Bags, 15c extra.)

Cement Drain Tile

Graettinger, Iowa. — Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in. 1.35; 36-in. 2.00

Longview, Wash.—Drain tile, per 100 ft.
3-in. 5.00
4-in. 6.00
6-in. 10.00

Tacoma, Wash.—Drain tile, per 100 ft.
3-in. 4.00
4-in. 5.00
6-in. 7.50
8-in. 10.00

Chicken Grits

Centerville, Iowa 9.25
Belfast, Me.—(Agstone), per ton, in carloads 10.00
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per ton 8.50–10.00
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each 8.00
Cranberry Creek, N. Y.—Per ton, in carload lots; in bags, 9.00; bulk, 7.50. Less than carload lots, in bags 12.00
Davenport, Iowa — High calcium carbonate limestone, in bags L.C.L., per ton 6.00
El Paso, Texas—(Limestone) per 100-lb. sack .75
Los Angeles, Calif.—Per ton, including sacks:
Gypsum 7.50 –9.50
Middlebury, Vt.—Per ton (a) 10.00
Randville, Mich.—(Marble), bulk 6.00
Seattle, Wash.—(Gypsum), bulk, ton 10.00
Warren, N. H. 8.50– 9.50
Waukesha, Wis.—(Limestone), per ton 7.00
West Stockbridge, Mass. ¶7.50–‖9.00
Wisconsin Points—(Limestone), per ton 15.00
(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton Wis. 10.50
Dayton, Ohio 12.50–13.50
Detroit, Mich. (d) e13.00–16.00*b
Farmington, Conn. 16.00
Grand Rapids, Mich.* 14.00–15.00
Jackson, Mich. 13.00
Madison, Wis. 12.50a
Mishawaka, Ind. 11.00
Milwaukee, Wis. 13.00*
Minneapolis, Minn. 10.00*
New Brighton, Minn. 8.00
Pontiac, Mich. 13.50
Portage, Wis. 15.00
Rochester, N. Y. 19.75
Saginaw, Mich. 13.50
San Antonio, Texas 12.50
Sebewaing, Mich. 12.50
South St. Paul, Minn. 9.00
Syracuse, N. Y. 18.00–20.00
Toronto, Canada (f) 13.00–15.00b
Winnipeg, Canada 15.00

Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10 days. (c) Delivered in city. (d) Also 15.50. (e) Also 14.00. (f) Also 10.75; 13.00 f.o.b. jobs, less 2.25 average cartage. (g) F.o.b. yard.

Concrete Block

Prices given are net per unit, f.o.b. plant of nearest shipping point.

City or shipping point	Size 8x8x16
Camden, N. J.	16.50
Chicago District	180.00–210.00a
8x10x16	230.00–260.00a
8x12x16	280.00–330.00a
Columbus, Ohio	13.00b– 15.00†
Forest Park, Ill.	21.00*
Grand Rapids, Mich.	11.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.:
Red 15.00
Green 18.00
Cicero, Ill.—French and Spanish tile (red, orange, choc., yellow, tan, slate, gray) per sq., 9.50–10.00; green or blue, per sq. 11.50–12.00
Detroit, Mich.—5x8x12, per M 67.50
Houston, Texas—Roofing Tile, per sq. 25.00
Indianapolis, Ind.—9x15-in. Per sq.
Gray 10.00
Red 11.00
Green 13.00

Cement Building Tile

Camden and Trenton, N. J.:
3x8x16, per 100, 9.00; 3x9x16, per 100.... 9.00
4x8x16, per 100, 12.00; 4x9x16, per 100.... 13.00
6x8x16, per 100, 16.50; 6x9x16, per 100.... 15.50
Chicago District (Haydite):
4x 8x16, per 100 13.00
8x 8x16, per 100 20.00
8x12x16, per 100 28.00
Columbus, Ohio:
5x8x12, per 100 6.00
Grand Rapids, Mich.:
5x8x12, per 100 6.00
Houston, Texas:
5x8x12 (Lightweight), per M 80.00
Longview, Wash.:
4x6x12, per 1000 55.00
4x8x12, per 1000 64.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	
Chicago District "Haydite"	14.00	
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	13.00a	
Forest Park, Ill.		37.00
Longview, Wash.	16.50	20.00– 40.00
Milwaukee, Wis.	14.00	18.00–20.00
Omaha, Neb.	17.00	30.00– 40.00
Philadelphia, Penn.	15.50	
Portland, Ore.	12.00	22.50– 55.00
Prairie du Chien, Wis.	14.00	23.00
Rapid City, S. D.	18.00	30.00– 40.00

(a) Delivered on job; 10.00 f.o.b. plant.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points.

16– 30 mesh 20.00
30– 60 mesh 22.00
60–100 mesh 18.00
100 mesh and finer 9.00

Note—Bags extra and returnable for full credit.

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.	.....	53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.	.....	55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.	.....	60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Grand Rapids, Mich. (b)	.....	.....	.....	.60	.70	.90	1.20	.....	.....	1.80	2.10	2.35	3.50	4.00	5.60	6.90	7.85
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....	10.00
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	.85½	.....	1.14	.....	.....	1.81	.....	2.47	3.42	4.13	5.63	6.49	7.31

(a) 24-in. lengths. (b) Reinforced. †21-in. diameter.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Wisconsin Concrete Products Association Holds Successful Annual Meeting

THE EIGHTH annual convention of the Wisconsin Concrete Products Association, held January 29-30, 1930, at the Plankinton hotel, Milwaukee, marked another high spot for that association, which has long been noted for its excellent constructive work in the concrete products industry. All the sessions were constructive as well as interesting, the papers holding the attention of the attending members and visitors. There were a large number of visitors from outside the state of Wisconsin, principally products manufacturers from Ohio, Indiana, Michigan, Illinois, Iowa and Minnesota. The opening session of the convention got under way with an attendance of 67, practically all of whom were concrete products manufacturers. This attendance continued to swell until the close, when over 240 people crowded into the convention room to hear the final address of the meeting, that of Harry J. Colman of Chicago.

Products Industry Improves Position

In opening the convention the president, D. R. Collins, of Milwaukee, brought out the fact that 1929 had been a severe one for the concrete products industry. Building had fallen off practically 30% and a tendency toward apartment living had quite considerably decreased the sale of concrete block for basement construction. Yet, in spite of this, he stated that the concrete products industry had gone through in splendid shape and had put itself in an even better position than ever before to meet competitive interests outside the industry. He urged the reading of trade papers, stating that these were the principal source supplying the business man with a correct knowledge of the new engineering and manufacturing methods, with sources of material supply, marketing conditions, sales and merchandising methods, store, office and plant management. Trade magazines, he said, were so essential to the life of the concrete products industry, in the estimation of the Wisconsin Concrete Products Association, that subscriptions to two of the leading magazines in the concrete products field have always been given to members as part of the service that the association renders.

Following Mr. Collins, Jack Franklin, secretary of the association, gave a brief report of the work that had been accomplished during the past year. Mr. Franklin was optimistic about the future, stating that, though business might be slow in coming, he felt that before 1931 is ushered in Milwaukee would have seen an era of home building that would compare favorably with any of the best years of the past.

"The Outstanding Job"

Next on the morning program were a series of five-minute reports by district representatives of the association. These men were all assigned the same subject, "My Outstanding Job and How I Landed It." These were indeed interesting and a goodly number of new selling points were gleaned by those in attendance from the experiences of their brother manufacturers throughout the state. This morning feature had been planned to dovetail into the afternoon session, the fore part of which was conducted by W. D. M. Allan, manager of the cement products bureau of the Portland Cement Association. Mr. Allan's subject, "The Ten Commanding Jobs," discussed the 10 outstanding concrete masonry jobs sold and erected during 1929, detailing the sales processes that had been used in selling each individual job. With each job he revealed in intimate detail the methods the various salesmen had used in putting it across. He pointed out that of the large jobs running into hundreds of thousands of units, not light weight products but sand and gravel units had come in for the lion's share of the work. This was an encouragement to the manufacturers of the so-called "heavy units" who had become rather discouraged and uncertain as to the suitability of their material for large work.

Following the discussion on Mr. Allan's paper the afternoon was concluded with a bit of horseplay intended to drive home a number of points important to the concrete products industry. This came in the nature of a mock trial whose guiding genius was P. C. Kolinski, manager of the Pyramid Block Co., West Allis, Wis. Concrete block was put on trial and numerous evidence in its favor was submitted in the form of exhibits, charts and reliable witnesses.

Manufacture and Sales Problems

The entire program for the second day of the convention was styled as a series of 10-minute papers on problems that enter into the manufacture and selling of various concrete products. The first of these papers, "Saving Dollars with Sense," by I. J. Westerveld, Wausau Concrete Co., Wausau, Wis., was read by R. J. Fisher (in Mr. Westerveld's absence), who also discussed it. This paper told how a concrete products business was established in a community having an abundance of natural stone which had for many decades been used for building and by the application of laboratory practice to plant operation this company has been able to produce excellent building units, staves, sewer and culvert pipe and trim stone at a price to compete favorably with other materials. Mr. Fisher, on concluding the discussion of this paper, showed a reel of movies of the Milwaukee Home Show home, an exhibit house in which concrete products are used extensively. The point he brought out in this exhibit was the fact that a small movie projector could be used effectively in putting across concrete products sales.

"Swapping Old for New—at a Profit," an interesting paper, was read by Charles Van Houten of Chicago. He related some of his experiences in underpinning and remodeling old residences.

Building Up a Reputation for Concrete Products

Oscar T. Nelson, deputy building inspector of the Wisconsin Industrial Commission, substituted for W. C. Muehlstein in giving the next paper on "Putting Responsibility in Place." Mr. Nelson commented quite freely on the tests that had been made by members of the Wisconsin association during 1929. Responsibility of the Wisconsin Industrial Commission, a legal one, and of the Wisconsin manufacturers, an ethical responsibility, are about equal, Mr. Nelson said. His talk was not, he stated, a criticism of concrete products manufacturers as a whole or individually, but a reminder that it is im-

portant to build up a good reputation and equally necessary to consider the more general and economic aspects of the industry in creating and adhering to uniform standards of high grade in the distribution of products.

Leon M. Gurda, city building inspector, said the "orderly development of a city depends entirely on how efficiently and scrupuously building and zone laws are enforced." Partiality to some tends to immediately lower the morale of the inspection department, he said, and to attain complete success enforcement must have the co-operation of all parties engaged in the building industries.

Typical Plant Designs

Gene Olsen, president of the Consolidated Concrete Machinery Corp., gave the last talk on the morning's program, "Five Practical Plant Plans." He exhibited one basic concrete products plant which he felt in his estimation, could be expanded to suit any production from 50,000 block per year up to 5,000,000. Following this he displayed a series of blue prints showing the construction of a number of typical plants located in various sections of the United States.

Sales Stimulants

The afternoon session on Thursday, January 30, was opened by George W. Porter of the Universal Atlas Cement Co., who spoke on "What Your Product Should Mean to Your Men." The man manufacturing products should take a real interest in stimulating sales, he said. If the concrete products manufacturer will only sell his employes, they in turn can do a great deal toward influencing public opinion toward the product of that manufacturer, he said.

"What the Editor Wants to Know About You and Your Products," originally assigned to Otto Steller, then editor of *Concrete*, but now of California, was presented by A. G. Alexander, editor of *Concrete Products*, who gave the convention a very interesting paper on the above subject.

Along the same subject, Norman M. Stineman, editor of *Concrete*, gave a number of hints on how to prepare usable newspaper articles telling legitimate news of the industry. Following this a few typical cases were considered and discussed.

The Milwaukee Co-operative

So much interest has been aroused the past six months in the development of the Milwaukee Concrete Products Co-operative Association, which handles the marketing of concrete block for 21 Milwaukee manufacturers, that the next paper, "Following Through on Sales," by F. W. Zilish, sales manager of the Co-operative association, was eagerly listened to. Mr. Zilish told something about the association, its organization and purpose, and carried the sale of a job of concrete building units through the association office from the time the prospect was first contacted until the final money had been collected. Centralizing credit information, expanding the market by promoting modernization of old Milwaukee homes and elimination of selfish competition in favor of co-operation are objectives of the Milwaukee co-operative organization, Mr. Zilish told the delegates.

The Where of Profits

Coming as a fitting finale for two splendid days of helpful talks and discussions was the address by Harry J. Colman, business analyst of the Lehigh Portland Cement Co., who used as a subject "What Does It Profit a Man If He Sells Every Job in Town and Then Loses His Shirt?" Starting with the Milwaukee co-operative, he worked into every fundamental of the concrete products business as it is today. The Milwaukee sales organization, handling products of 21 manufacturers and dealers, is one of the first sincere attempts to stabilize prices and the market and to work toward the raising of the industry's business standard, he said.

Mr. Colman said business in 1930 "will be just exactly what you make it, and little more," and he warned against the psychological fear that depresses business.

Supply Exceeds Demand

"The building industry has been too easy to enter," he said. "There is 50% more production than the demand justifies, and there has been a tendency to bring business standards down to the level of the 10% who are not thoroughly honest. Advancement can come only through the banding together of the better element which accepts as the fundamental principle the fact that net profits are the only true measuring stick of business conditions."

Price reduction to stimulate increased volume is a "false, untrue and pernicious theory, fundamentally wrong in a business dealing in staples, such as building materials," said the expert.

New Officers

The new officers of the association elected for 1930 are: D. R. Collins, president; Harry C. Shields, vice-president; Jack Franklin, secretary-treasurer; Gladys Burnquist, assistant secretary, and R. J. Fisher, field engineer.

Through the generosity of several manufacturers of concrete machinery and producers of light weight aggregates a splendid program of entertainment was given at the banquet which concluded the two-day session.

Northwest Products Association Holds Annual Meeting at Seattle

THE FIFTH annual meeting of the Northwest Concrete Products Association, held at the Gowman Hotel, Seattle, Wash., January 24 and 25, again brought together representative manufacturers of concrete products from some 50 plants located in Oregon, Washington and Idaho. Among those present also were several representatives of the steel industry who supply the reinforcing products, and several new members who have joined the association during the past year.

Association Activities

The meeting was opened by President William McKenzie, who gave a brief outline of accomplishments of the association during the past year. Mayor Frank Edwards of Seattle was the principal speaker and warmly welcomed the concrete manufacturers, figuratively giving them the key to the city.

The report of Secretary-Treasurer W. P. Hews, which included the financial report, showed that the association's finances were in good shape. Considerable cut was made in the advertising during the past six months and in this connection William Sharp, chairman of the advertising committee, stated that this condition was only temporary. He advised that good results had been obtained from group advertising and that the industry in this way presented a united front, which in many cases had secured the use of concrete products in preference to competitive ones.

Considerable of the morning session was given over to the discussion of the A.S.T.M. specifications on sewer pipe and its reinforcing in sizes above 24 in. It was brought out in discussing further specifications on the 27- and 30-in. sizes that the wall thicknesses should be increased, leaving the reinforcing specifications as they are.

Opening the afternoon's session, Hans Mumm, Jr., of the Everett Concrete Products Co., discussed the proper laying of pipe, urging that the manufacturers watch closely their tamping. He called the attention of the members to the new specifications recently issued by the state of Washington on culvert pipe.

Protecting Concrete Pipe

Dr. H. J. Benson, dean of chemistry at the University of Washington, gave a most interesting and instructive address on "Concrete Chemistry," in which he told the manufacturers of a number of tests and experiments carried on during the past summer at the plant of the Western Pipe Manufacturing Co. at Los Angeles. He predicted that undoubtedly research would find something that would deter the inroads of calcium sulphate and acids.

Prof. Benson stated that an experimental sewer in which had been incorporated some

90 specimens covered with various coatings some two years ago was holding up well, no spoiling action being as yet manifested. For resisting action of acids, cumarin resin was used on samples, and also "Duco," but eventually acid worked through both. Among the various compounds used were cold tar pitch emulsions, and to date these look promising. In making the sample, a centrifugal machine was used, and also concrete pipe rubber lined. The rubber latex is thrown in when the pipe is half spun and a very attractive latex coated and self-vulcanized tile was shown. Emulsified asphalt lined with rubber laid on the inside of the pipe after a 90-day test showed no effect from the acid, he said. Tests with "Bakelite" lined concrete pipe had shown interesting results.

Improving Quality of Products

C. W. Kief, structural department, Portland Cement Association, spoke on "Concrete Masonry," urging the manufactures to manufacture only quality products and do everything possible to educate the public toward the greater use of concrete units. He sketched briefly the thermal activity (loss of heat through concrete) and advised that data on this subject are being assembled by the Portland Cement Association and would soon be available. In closing he emphasized quality, plus advertising both locally and nationally, and the use of modern salesmanship to dispose of their products.

E. G. S. Pryor, resident engineer, Underwriters' Laboratories, touched briefly on the work done in their laboratories, giving them a few high lights of some 30 years work done at Chicago, New York and at San Francisco. He expected that at some time a strictly concrete group would be founded, to amend and improve the standard of products. A. W. G. Clark of Vancouver, B. C., gave some interesting data on Canadian products and manufacturers. He reported that British Columbia manufacturers had inaugurated a most aggressive selling campaign and that great progress had been noted during the past six months in stimulating the use of concrete products, especially in the city of Vancouver.

Bailey Tremper, engineer of tests, Washington State Highway Department, took up at some length the new specifications for concrete culvert pipe. He advised that their department would not insist on a 28-day test, but if materials were placed that had been cured in a shorter time, that the manufacturer would have to guarantee his pipe. Both strength and absorption tests would be required.

More Experimentation Needed

Prof. Ira L. Collier, of the University of Washington, outlined the experimental work carried on by himself and students at the university during the past year, comparing the wet and dry mixes, showing figures obtained from a wide range of mixes. J. R. Thompson, consulting engineer, U. S. Steel Products Co., asked that the steel industry be advised as to reinforcing steel that would be required by the concrete manufacturers, and if possible the exact sizes, and allow the steel companies to carry a smaller stock.

A most timely and interesting address was given by Wylie Hemphill, president of the Seattle Chamber of Commerce. He described unfair competition as plain ignorance. With regard to concrete pipe, he stated, price cutting was all wrong and should be frowned on. He urged that concrete products manufacturers should boost each other's business and, through co-operative advertising, sell the industry. An endeavor to educate the few manufacturers who are "still out of step" on this question should be made, he said.

New Officers

Bellingham, Wash., was selected as the midsummer meeting place, the date to be announced early in June. The election of officers resulted in the unanimous choice for president of Hans Mumm, Jr., of Everett, Wash., a charter member of the association. Clyde Grutz, Portland, Ore., was elected first vice-president; Carl Warren, Spokane, second vice-president, and Ed Warner, Tacoma, third vice-president. W. P. Hews, Yakima, Wash., was re-elected secretary-treasurer.

Granite-Concrete Products

A NEW type of concrete building unit, featuring the use of crushed granite aggregate, will soon be made at Berlin, Wis., according to the *Berlin* (Wis.) *News*. The report states that William Wiske and Clark Berray of Berlin have been successfully experimenting with this type of block and are about ready to undertake its manufacture. These blocks have excellent strength and can take a high polish similar to the usual natural granite.

"Those posted on the problems of finding a market for granite in competition with machine-made building materials and paving," says the *News*, "feel that the local (Redgranite, Wis.) granite industry will make its greatest progress through the medium of granite-concrete products."

Metal Spraying on Concrete, Cement and Cast Stone

A NEW metallizing process by which a well-adhering, impermeable coat of metallic lead is sprayed on concrete, cast stone or other cement products, is described in a recent issue of *The Stone Trades Journal* (England). This process, known as Dr. Schoop's, consists of spreading under high pressure of gas, finely pulverized metal in liquid form on to the surfaces of the materials. The particles of metal have the tendency to fill up the pores and unevenness of the surface, thus a complete and strong metal covering is welded on to the material, yielding a perfect compactness. Any metal may be used, but lead is the most recommendable one for concrete and brickwork, owing to its steadiness and toughness in different weather conditions.

Although the principal application is for coating the exterior surfaces of the objects, the process is equally suitable for the insides of basins, reservoirs and tubes.

Some time ago experiments were made on weirs and similar constructions under the direction of Professor Engineer Gamba of the Technology of Torino (Italy). The results which were obtained were equally valuable and interesting.

Similar tests have also been made by the Swiss Society of Hydraulic Works. They proofed the closeness of slabs of concrete, one coated and the other without, against water under high pressure. The register of the experiments showed that not even the smallest quantity of water oozed through the metallized surface.

Another instance where Dr. Schoops' method is applicable is for leading concrete, and also of equal interest is the use of this process in lead covering for flat roofs.

Owing to the influence of sunshine and rain, the covering of roofs consisting of bitumen become worn because of certain compounds in the material such as the volatile oils which evaporate. This process, whereby concrete roofs can be metallized, is therefore claimed to become a great success in the building trade, especially as flat roofs are more and more popular.

Further, a covering of lead is the best material for facing moisty cellars, tunnels, tubes, etc., and it is the best protection for facades consisting of any material. Besides that, it can be used successfully in the acid industry for lining basins and tubes.

A skilled workman can easily spread 1 sq. yd. of surface in 10 minutes. The "Homogen-pistol" is worked by compressed air and dissous-gas, and is so simple that a workman of any average intelligence can learn everything there is about it within two or three days, it is said.

Concrete Roads in Texas

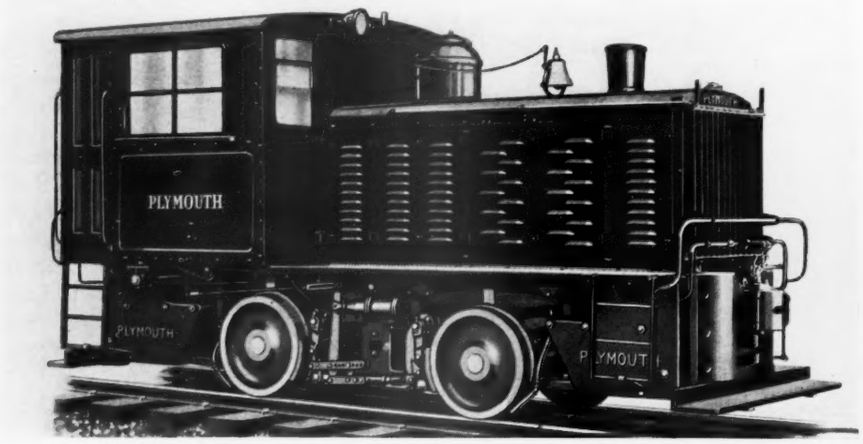
TESTS made by the laboratories of the Bureau of Engineering and Research, University of Texas, and the Texas state highway department, on the concrete roads in Texas, have been incorporated into University of Texas Bulletin No. 2922. The data therein are based on 8000 concrete cylinders tested and 1000 cores from concrete roads laid in Texas during 1928.

Among the significant features developed in these tests are: Concrete laid during fall and spring has the highest crushing strength and that laid during the winter months is the weakest; concrete cylinders cured by sodium silicate and Hunt process have lower crushing strengths than the water-cured cylinders.

New Machinery and Equipment

New Line of Gasoline Locomotives

THE Fate-Root-Heath Co., Plymouth, Ohio, has brought out a new line of gasoline locomotives known as Model "ML6" in three sizes—20, 25 and 30 tons, and Model "ML8" in two sizes—30 and 35 tons. Model ML6 is powered by a 6-cylinder Le Roi engine, while the ML8 is equipped with an 8-cylinder V type Le Roi engine.



New gasoline locomotive featured by side and cross equalizers

The frame is a patented bar-steel type of special construction using equalized semi-elliptic springs to advantage. The springs are long and flexible, being 48 in. long and 4½ in. wide.

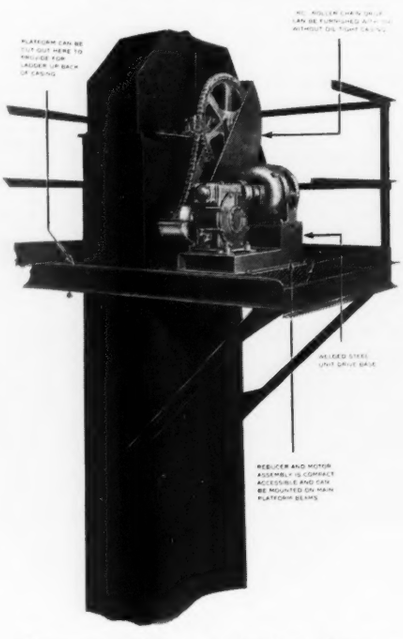
A new and special feature claimed for the locomotive is the equipping with both side and cross equalizers, giving, it is said, a true 3-point suspension, so that the locomotive rides rough track with ease. An improved clutch, that is removable without moving the engine or transmission, is used. The size has been increased to 16 in. in dia., with 6 facings for the 6-cylinder and 8 faces for the 8-cylinder engine.

These models are now equipped with two 12-v. starters, direct-driven air compressor and other improvements.

New Compact Drive for Bucket Elevators

A NEW elevator drive for bucket elevators of the centrifugal discharge, perfect discharge, or continuous bucket types is announced by H. W. Caldwell and Sons Co., Chicago, Ill. These drives are built to operate elevators requiring from 3 to 15 hp., the entire line being standardized and carried in stock for prompt shipment. The first reduction of the drive is made up of a ruggedly built, fully enclosed worm gear speed reducer to which a motor is coupled. The motor and the worm reducer are accurately aligned on a welded steel base, making a compact assembly easily supported on the elevator casing or platform.

The welded steel base is made to fit the installation. Some bases are furnished with extensions at the motor end, to span the full width of the casing, so as to be mounted on the projecting platform beams. Others are mounted directly on such platform, walkaway or other support, as shown in the cut.



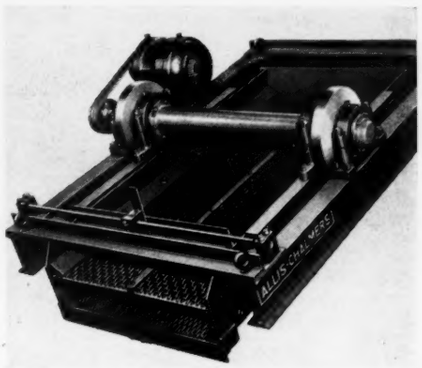
Compact drive on a bucket elevator

The second reduction in speed is made by a Link-Belt "RC" class roller chain, engaging with cut steel pinion on worm gear shaft and with cut cast iron sprocket on elevator head shaft. The chain also acts as a flexible connection between reducer shaft and head shaft.

Reasonable speed changes in the elevator head shaft can be made by changing the size of one or both of the sprocket wheels.

Centrifugal Vibrating Screen

A NEW centrifugal vibrating screen, in various sizes, for sizing and screening wet or dry materials, is announced by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The centrifugal vibrating motion of this new screen is positive, mechanically produced, and due to the novel method of attaching vibrating mechanism to screen body the vibrating motion is claimed to be equal over the entire screen surface.



Centrifugal double-decked vibrating screen

The mechanical features are quite simple, the machine consisting of three principal parts—a supporting frame, the screen body and the vibrating mechanism. The supporting frame is built up of two heavy "I" beams rigidly fastened together by cross ties which are electrically welded together. The screen body or vibrating member is made of steel plate sides, cross-connected by structural steel members welded to the side plates. The connection of the screen body to the vibrating mechanism is through two heavy steel bars welded to the side plates by means of connecting angles all securely welded together. The vibrating mechanism consists of a heavy steel shaft carried in two oversize high grade roller bearings, mounted on the supporting frame in self-aligning dust proof buildings. This shaft carries on each side, just inside the supporting frame, two

heavy balance wheels which are protected by steel housings. Between the balance wheels the shaft is turned eccentric for a short distance for the vibrating screen body bearings, which consist also of roller bearings carried in self-aligning housings.

The screen may be driven by a separately mounted motor through a belt; or preferably by means of a totally enclosed fan cooled motor mounted on the stationary frame and connected to the screen drive shaft by a Texrope drive. One, two or three decks of screens can be carried on the frame. When made of wire cloth, the screens are bolted to frames of welded steel construction, so arranged as to be easily removed and replaced.

The entire screen body is held in proper position by means of a round spring steel reed, arranged so the entire screen frame and decks may have their inclination quickly and easily changed in relation to the stationary frame to take care of change in the screenability of the material.

Improved Rotary Sand-Lime Brick Press

A NEW 16-mold rotary brick press, designated as No. 180, has just been announced by the W. A. Riddell Co., Bucyrus, Ohio. The new press has eight double molds, giving a rated capacity of 3000 brick per hour.

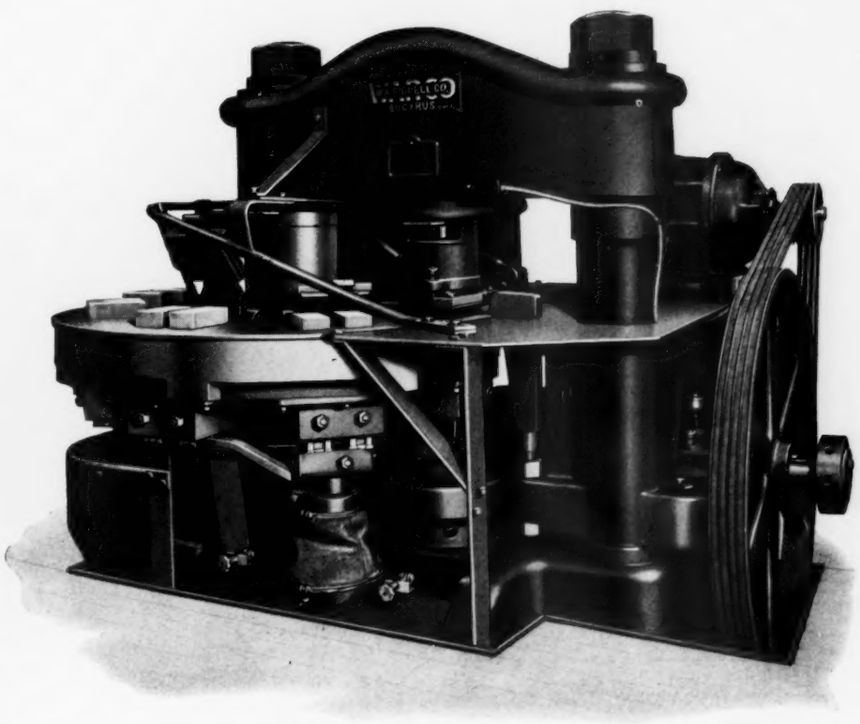
The machine is adapted for making pressed brick from semi-dry, granular or pulverized material, and is designed to operate under heavy working pressure; the automatic relief device releases at 225-ton pressure.

The press consists essentially of heavy reinforced base and frame castings; a revolving mold table which contains eight double, steel-lined molds; suitable mechanism for driving and locking the mold table; an automatic feed hopper; a series of pressing levers; and the necessary gearing to operate the press. It is designed for operation by independent motor drive.

A feature of particular importance on the new press is the special patented steel cover plates, which are attached to the revolving table and to which the upper pressure plates for each mold are attached. By this arrangement, sharp-edged brick are possible, it is claimed, and also various shapes of bricks such as arches and wedges can be made, by simply changing the shape of the upper and lower pressure plates, or to press brick with frogs, trade marks or names merely by applying proper upper and lower pressure plates, the manufacturers say.

Pressure is applied from the bottom through a crank shaft and walking beam, and the same mechanism operates a vertical plunger lift-out which raises or ejects the pressed brick out of the mold at the same time the pressure is being applied to a mold under the pressure plate. The mechanical action is intermittent, two bricks being pressed at a time. While two bricks are being pressed, two bricks are being ejected and two molds are being filled at the charger, one double mold is standing full between the charger and the pressure plate, and the remaining molds are all in position for the operator to remove the brick which have been pressed and raised to table level.

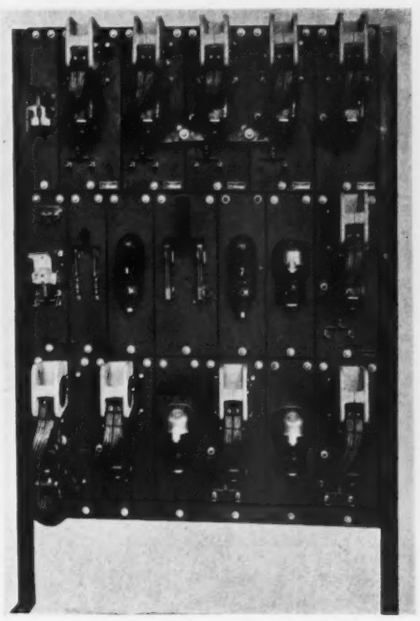
Another feature of the press is the steel liners for the molds which are interlocking and reversible. They are constructed of laminated steel, having two hardened surfaces with a soft center. The liners are accurately fitted and are readily inserted or removed from the machine when required. They are so made that the wearing surfaces may be reground and reversed so as to greatly prolong the service life of the liners.



Usual types and special shapes of brick are made on this improved sand-lime brick press

Dynamic Braking Controller for Crane Hoists

A NEW dynamic braking controller for crane hoists is announced by the Electric Controller and Manufacturing Co., Cleveland, Ohio. The improved device is claimed to insure instantaneous brake release,



Braking controller for crane hoists

thus giving, it is said, faster crane operation, more accurate control of short, quick movements, and better ability to spot loads.

Some of the advantages advanced for the new controller are: Faster speed when lowering light loads or empty hook; reduced power consumption on all loads at all speeds; greater power return to the line when lowering overhauling loads; reduced peaks of current; lower heating on the motor; less contactor wear; fewer movements when inching for accurate stopping of load.

Chain Drive Service

LOCAL distributors of Link-Belt equipment are now in a position to offer immediate delivery on chain drives, according to an announcement by the Link-Belt Co., Chicago. This latest extension of the Link-Belt distribution service includes the "stocking" of roller-chain drives at local points.

News of All the Industry

Incorporations

Hornell Gravel Corp., Hornell, N. Y., $50,000.

Atlas Stone Co., 17141 Joseph Campau, Detroit, Mich., 5000 shares no par value.

Kolinski Ready-Mixed Concrete Co., Milwaukee, Wis. F. McGovern, F. Rausch and others.

County Sand and Stone Corp., White Plains, N. Y., $850,000. E. R. Eckley, Mamaroneck, N. Y.

Tri-State Stone Co., Davenport, Ia., reported as having filed certificate of dissolution.

Verona Sand and Gravel Co., Stoughton, Wis., $50,000. F. R. Hyland, H. C. Peterson and F. M. Lipke.

Luck Creek Stone Co., Howard, Wis., 250 shares common at $100 each. M. Beemster, W. Sheedy and C. G. Chadek.

Ideal Tile-Brick Co., Inc., Lafayette, Ind., 2500 shares, no par value. George F. Boes, Mayme Boes and A. W. Richmond.

Michigan Gypsum Co., Grand Rapids, Mich., 100 shares no par value. To deal in gypsum and kindred products.

Nueces River Sand and Gravel Co., Corpus Christi, Tex., $5000. L. A. Cage, J. E. Garret and William McKennon.

Warner R. Thompson Co., 407 Curtiss Bldg., Detroit, Mich., 5000 shares, no par value. To deal in limestone and other products.

Bluffton Stone Co., Bluffton, Ohio, 500 shares, no par value. Raymond Conrad, Gilbert Fett and C. B. Fett, Bluffton.

Kentucky Limestone Co., Russellville, Ky., $50,000. John W. Diebold, Anton Diebold, Sr., and J. S. Diebold.

Blue Bell Lime Co., Fleetwood, Penn., $10,000. Norman B. Ringler, Fleetwood; Frank A. Kremser and Elizabeth M. Kremser, Philadelphia.

Henry C. Ische and Sons, Inc., Milwaukee, Wis., 750 shares at $100 each. To deal in sand and gravel. Henry C. Ische, V. L. Ische and M. F. Ische.

Delphos Quarries Co., Delphos, Ohio, 1000 shares preferred stock of $100 par value and 1000 shares common stock, no par value. E. H. France, A. C. Hirth and M. G. Leatherman.

Standard Pulpstones, Inc., Morgantown, W. Va., $50,000. Walter M. Loy, Clarence H. Harding, Anna J. Harding and Albert Shuman, all of Morgantown, and Leo C. Smallwood of Elyria, Ohio.

P. Flannery and Sons, Inc., 2105 State St., East St. Louis, Ill., $60,000. To deal in lime, cement, etc. James P. Flannery, Vincent H. Flannery and Charles E. Flannery.

Bianchi Cast Stone Co., Quincy, Mass., $100,000, 1000 shares at $100 each. President and treasurer, Angelo Bianchi, 356 Granite St., Braintree, Mass.; L. F. Bianchi and A. L. Bianchi.

Wapak Sand and Gravel Co., Wapakoneta, Ohio, 1200 shares common, no par value. Ralph Heffner, president; John Brands, vice-president; W. P. Greer, secretary-treasurer; H. Y. Miller, superintendent, and John Frontz.

Quarries

The Napoleon Granite Works, Napoleon, Ohio, formerly owned by L. B. Shreves, has been sold to M. L. Reynolds, Wauseon, Ohio.

Indiana Limestone Co., Bedford, Ind., has received a contract for 450 cars of stone to be used in the construction of the new Empire State Bldg. in New York City.

Redgranite, Wis. A total of 3650 cars of quarry products were shipped from Redgranite and Lohrville during the year 1929. This figure falls within 200 cars of the amount shipped in 1928.

Black Marble and Lime Co., Enterprise, Oregon, which has not been operating for some time, is reported to be making financial readjustment to enable operation to start again soon.

Rockford Stone Co., Rockford, Ohio, moved a new crusher from the C. N. Ry. to its plant northwest of Rockford recently. The quarry has operated practically all winter and is getting ready for an early start the coming spring.

Northern Pacific Railroad is operating its rock quarry at Emigrant, Mont., to secure rip rap stone to guard its property at exposed points from encroachment by the Yellowstone river from Yellowstone Park to Glendive, Mont.

Bellefonte Lime Co., Salona, Penn., has increased its capacity to 850 tons of crushed stone a day. This represents a daily increase of about 150 tons of crushed stone. J. Linn Harris is manager of the plant.

The Western Quarry Co., Tenino, Wash., held its annual election of officers recently. Andrew Wilson was re-elected president; F. W. Wichman, vice-president, and George McMillan, secretary-treasurer.

The Waller Stone Co., which operates a quarry at McDermott, Ohio, is preparing to open a new quarry on the Sharp farm near Sugar Grove, Ohio, to produce sandstone. Clark W. and F. M. Waller of Lancaster, Ohio, are associated in the company.

Green Bay, Wis. The state reformatory has obtained a four-year option on the McCrusty granite quarry northeast of Amberg, Wis., preparatory to quarrying stone for the new state office building at Madison, Wis.

Fort Collins, Colo. The new limestone quarries in the Owl canyon region will have improved transportation facilities now that the Colorado and Southern railroad has completed its Ingleside branch line, which extends five miles west of Fort Collins, Colo., to the quarries.

Van Nuys, Calif. G. H. Graber and H. W. Jones will construct a rock bunker in the Sunland district, to be 46x59 ft. in size. Bodinson Manufacturing Co. has designed the plans for the structure, which is to cost approximately $30,000. The company will maintain an office at 5731 Colfax Ave., North Hollywood, Calif.

Sand and Gravel

Dixie Sand and Gravel Co., Chattanooga, Tenn., now has under construction another towboat for its sand and gravel operations.

A. M. Hallett Co., Crosby, Minn., has purchased an 80-acre gravel tract in the Onamia, Minn., district from Harvey Sumner and plans to establish a gravel washing plant here.

Clarence Construction Co., Clarence, N. Y., is opening a new gravel pit on the Jerome Riddle farm at Alexander, N. Y. Gravel will be hauled from this pit to the prison site in Attica.

Nugent Sand Co., Louisville, Ky., is to have two new steel barges, 100x28x7 ft. 3 in. in size. The barges are being constructed by the Howard Shipyard and Dock Co.

Lenewee Sand and Gravel Co., Tecumseh, Mich., re-elected the following officers at its recent annual meeting: J. T. Carpenter, president; Fred Blouch, vice-president, and Charles Thurlby, secretary and treasurer.

San Antonio, Tex. The city will acquire a 15-acre gravel pit at Castroville Rd. here, to supply gravel for street construction and repair work. Operation to be in charge of Paul Steffler, street commissioner.

Portsmouth Sand and Gravel Co., Portsmouth, Ohio, recently developed a locomotive or motor sand at its Sciotoville plant and is shipping large quantities for mine use into the West Virginia coal fields. The plant has a capacity of 1000 tons daily.

Cement

Signal Mountain Portland Cement Co., Chattanooga, Tenn., held its annual meeting recently, at which the officers and members of the board of directors were re-elected.

Lehigh Portland Cement Co., Allentown, Penn., held its annual stockholders' meeting on January 15 and the following directors were re-elected: General H. C. Trexler, Colonel E. M. Young, George K. Mosser, Daniel E. Ritter and A. F. Walters.

Lone Star Cement Co. of Alabama, Birmingham, Ala., was visited recently by three executives from the parent company, International Cement Corp., New York City. The visitors were H. C. Koch, vice-president; H. H. Muehlke, treasurer, and T. Avnsoe, vice-president in charge of operations.

Silica Sand

Industrial Silica Corp., Youngstown, Ohio, shipped a total of 500,000 tons of silica sand in 1929, principally to iron and steel companies.

Gypsum

Gypsum Lime and Alabastine, Ltd., Paris, Ont., is said to be planning a plant and plaster board mill at Calgary, Alta., to cost $150,000. R. E. Haire is president and general manager.

Standard Gypsum Co., Seattle, Wash., announces removal of offices from the Alaska Bldg. to new office quarters recently constructed at the mill. The change will enable the company to give customers quicker and better service.

American Gypsum Co., Port Clinton, Ohio, elected the following officers at its recent annual meeting: John A. Kling, chairman of the executive board and general manager; Harry Benn, president; Howard McCrady, vice-president; J. B. Davis, secretary and treasurer; Fred Wolfe, works manager, and Arthur Black, general sales manager.

Agricultural Limestone

Illinois. Farmers of this state during the past ten years have spread over 5,000,000 tons of agricultural limestone which came from commercial quarries. It is estimated that limestone has added from $10 to $34 an acre to the wealth of the state in increased crops.

Cement Products

Brooksville, Penn. Amil Monnoyer and Elmer Ferguson are constructing a cement block plant here, according to reports. One building is already up, another will be erected just as soon as the land is made available, and if enough additional acreage can be obtained by the firm, a sand and gravel storage plant may be started.

Mercedes Concrete and Pipe Co., Mercedes, Tex., at its recent annual meeting elected the following officers: W. F. Shaw, formerly vice-president and engineer for the American Rio Grande Land and Irrigation Co., as president; H. B. Seay, who was president of the company for several years, has been named chairman of the board of directors; J. C. Shaw was re-elected vice-president, as were H. M. Rouse, secretary-treasurer, and Clarence Rouse, assistant secretary-treasurer. The offices of the company are now being remodeled and enlarged.

Miscellaneous Rock Products

Berlin, Germany. The principal potash concerns of Germany, including the Wintershall and the Salzdetfurth-Aschersleben, have decided to establish a holding company. Its purpose will be the fusing of operations and the creating of a sales organization for all potash by-products. The undertaking is regarded as the first step toward creation of a general potash trust in Germany, concerning which negotiations were held last year with the government.

Obituaries

Jack Kain, 62, pioneer granite producer of Llano, Tex., died February 5.

Fred M. Kimball, advisory manager of the motor division of the industrial department of the General Electric Co., Schenectady, N. Y., died February 5 in Lynn, Mass.

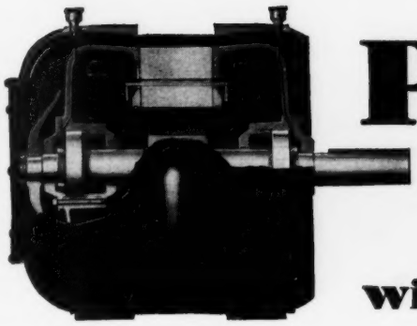
William M. Acheson, chief engineer of the department of public works of New York state, and formerly chief engineer for the Crescent Portland Cement Co. of Pennsylvania, dropped dead suddenly on January 25.

Personals

E. B. Bushnell, formerly connected with the Portland Cement Association, is now associated with the Masonite Corp., Chicago, Ill.

William J. Brant of Pittsburgh, Penn., was elected a director of the Industrial Silica Corp., Youngstown, Ohio.

H. A. Henry of Pataskala, Ohio, has signed a contract with the Canadian Foreign Investment Co. and will go to Brazil on behalf of that company.



Permanent Protection

without sacrificing accessibility

. . . that was the thought in mind when the Allis-Chalmers type "ARZ" motor was developed. The active parts of this motor are completely enclosed, protecting the stator windings and the rotor — those parts that are subject to injury — from sulphurous gasses, acids, alkalis, dust, etc.

End closures and bearing supports, including lubricating devices, are combined into single castings and make this motor as accessible as the conventional open type. There are no rubbing or revolving seals. Cooling air is furnished by a single fan keyed and locked on a short shaft extension opposite the drive end. The mounting space of this enclosed motor is the same as the open type in most ratings.

LEAFLET 2109 tells about these and other standard Allis-Chalmers features. . . . *Write for a copy.*

ALLIS-CHALMERS MANUFACTURING COMPANY ▲ MILWAUKEE

Joseph Davis has been appointed executive vice-president of the American Locomotive Co., New York City.

William M. Kinney, general manager of the Portland Cement Association, was elected a director of the American Road Builders' Association at its recent annual convention at Atlantic City, N. J.

Gordon Huth of Duluth, Minn., has been appointed safety director of the Universal Atlas Cement Co., Chicago, Ill., subsidiary of the United States Steel Corp.

B. G. Richmond has resigned as general manager of the Waterbury Co., New York City. Mr. Richmond was engaged in executive and sales development work for the company for 25 years.

Walter F. Petersime, Gettysburg, Ohio, has been transferred from the Greenville, Ohio, plant of the American Aggregates Corp. to Kalamazoo, Mich., where he will manage one of the company's branch offices.

F. T. Magennis, former vice-president of Goodyear Tire and Rubber Co. of Cuba, has been appointed manager of the Goodyear Tire and Rubber Co. of South America. He will be stationed in Brazil, with headquarters in Sao Paulo.

George W. Maisak of Brooklyn, N. Y., has been added to the sales staff of the Consolidated Products Co., New York City, and will confine his activities to the crushing, pulverizing and drying machinery department.

William Henry Harrison, consulting and valuation engineer, and a contributor to the columns of ROCK PRODUCTS on valuation and tax subjects, announces the removal of his office from the National Press Bldg. to the Denrike Bldg., Washington, D. C.

Chas. H. Gaut, formerly connected with the American Limestone Co., Mascot, Tenn., has recently become affiliated with the Nordberg Mfg. Co., Milwaukee, Wis. He will be engaged in sales and service of Nordberg-Symons crushers south of the Ohio river, with headquarters at Fountain City (P. O.), Knoxville, Tenn.

Philip Dawson, Manitowoc, Wis., secretary of the Manitowoc Portland Cement Co. and the Medusa Portland Cement Co., Cleveland, Ohio, with which the Manitowoc company was recently consolidated, will now be located at the company's Cleveland offices. **Ephraim Broderick** of the Manitowoc office will also be transferred to Cleveland.

W. Earle Pashley, advertising manager of the C. F. Pease Co., Chicago, Ill., has been appointed assistant sales manager and second vice-president of the company. Simultaneous with that appointment, Mr. Pashley was elected to the board of directors, and in addition to his new responsibilities will continue in charge of advertising and promotional activities.

E. F. Schaefer, vice-president in charge of sales of the Gardner-Denver Co., Denver, Colo., has just finished a trip through the northwest visiting various branch offices of the company. **J. R. Farrell** has been transferred from the St. Louis office to the Tulsa office as rock drill representative. **E. H. Diamonds,** formerly of the Andrews and George Co., agents in Japan, is now associated with the San Francisco office as rock drill salesman.

Wallace W. DuPre, for 14 years sales manager of the Knickerbocker Co., Jackson, Mich., has purchased a substantial interest in the business of Thomas Brown, Inc., Baltimore, Md., and Washington, D. C., distributors of Knickerbocker concrete, mortar and plaster mixers, etc., and will make his headquarters in Baltimore. He retains his interest in the Knickerbocker Co., remains its vice-president, and will give his general attention to the company's eastern sales.

Manufacturers

Cutler-Hammer, Inc., Milwaukee, Wis., announces that its Detroit district sales office will now be located at 2755 East Grand Boulevard, Detroit, Mich.

Stephens-Adamson Manufacturing Co., Aurora, Ill., announces that its Seattle, Wash., sales and engineering office in the Skinner Bldg. will be in charge of Charles J. Horn.

Hercules Powder Co., Wilmington, Del., in its annual report just issued showed net profits for the year 1929 were $4,358,904.38, as compared to $4,038,980.67 for 1928.

Pennsylvania Pump and Compressor Co., Easton, Penn., announces the appointment of the Kring-Becker Engineering Co., Mercantile Library Bldg., Cincinnati, Ohio, as its representative in the Cincinnati and Louisville districts.

Inland Steel Co., Chicago, Ill., has purchased from the Elk Horn Coal Corp. its Wheelwright mine with its plant and equipment in the eastern Kentucky coal district, and has leased from the Elk Horn company about 11,000 acres of coal. This will give the Inland company an adequate reserve of high-grade by-product coal.

Linde Air Products Co., New York City, and associated companies will occupy Booth No. 281 at the Oil Equipment and Engineering Exposition to be held at the Shrine Auditorium, Los Angeles, Calif., on March 16-23. A full line of the company's welding and cutting apparatus will be on display.

Haynes Stellite Co., New York City, at its recent directors' meeting appointed E. E. LeVan general sales manager and J. H. Maguire as works manager. Other appointments were F. T. McCurdy, plant superintendent; J. R. Brown, F. L. Secord and Everett Page, assistants to superintendent, and L. H. Brown, research engineer.

Falk Corp., Milwaukee, Wis., has made an arrangement with Root, Neal and Co., Buffalo, N. Y., to sell Falk products in that section. The new selling outlet will handle Falk herringbone parallel shaft speed reducers, right angle reducers, and Falk flexible couplings. Youngstown Steel Sales, Inc., Youngstown, Ohio, will also represent the Falk Corp. in the Youngstown territory.

Trackson Co., Milwaukee, Wis., has announced plans for the erection of a new factory early in the spring. The company has obtained 21 acres in Milwaukee's south side manufacturing district and the entire Trackson plant will be housed in the new factory, which will provide ample room for the manufacture of the complete line of tractor equipment.

Link-Belt Limited recently opened a branch office in the Standard Bank Bldg., 510 West Hastings St., Vancouver, B. C., in charge of Frank B. Wetherill. In establishing this new office, it is aimed to supplement the service rendered through Fleck Bros., Ltd., Canadian Fairbanks-Morse Co., Ltd., and A. R. Williams Machinery Co., Ltd., who will continue as official distributors for Link-Belt chain and other merchandise material.

Northern Blower Co., Cleveland, Ohio, as one of the features of its exhibit at the recent Ohio Safety Congress, showed a working model of a Norblo dust collecting system fitted to a set of miniature buffing lathes, saws, planers, etc. The two representatives present, L. L. Eiben and Mr. Pike, demonstrated the manner in which dust, shavings, etc., can be removed from the air of workshops by air suction.

E. I. du Pont de Nemours and Co., Wilmington, Del., held the 14th annual meeting of the technical section of its explosives department at Wilmington, Del., on February 4-6. Arthur La Motte, manager of the section, presided. More than one hundred subjects relating to explosives and their uses in mining, construction and for industrial purposes were discussed by the du Pont executives and field representatives from all parts of the country.

Foote Bros. Gear and Machine Co., Chicago, Ill., has appointed Max E. Landry, 202 Local Bldg., Oklahoma City, Okla., representative of the company in the northern half of Oklahoma on its line of IXL gears and speed reducers. The Ammex Equipment Co., 406 San Francisco St., El Paso, Tex., has been named district representative of the Texas territory lying west of a line drawn from Farwell to Sweetwater and then south to Spofford, Tex., and all of New Mexico and the entire Mexico territory with the exception of Nuevo Leon and Tamaulipas.

The P. H. and F. M. Roots Co. has merged with other interests and is now under the control of the Stacey Engineering Co., Columbus, Ohio. The new organization includes the P. H. and F. M. Roots Co. and the Connersville Blower Co., both of Connersville, Ind., the Wilbraham-Green Blower Co. of Pottstown, Penn., and the Stacey Bros. Gas Construction Co. of Cincinnati, Ohio. Officers are Col. Carmi A. Thompson, president; Corwin Abbott, vice-president and general manager, and E. G. Meeks, secretary and treasurer. All companies involved in the merger will maintain their separate identities and organizations.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Shovels. Illustrated folder covering the various types of Lorain shovels with Thew center drive. THE THEW SHOVEL CO., Lorain, Ohio.

Dredging Pumps. Bulletin **No. 136,** covering heavy-duty lined dredging pumps suitable for 150-ft. total head. MORRIS MACHINE WORKS, Baldwinsville, N. Y.

Floor Liner. Circular covering the Nissly heavy duty floor liner for industrial boundary lining. Especially valuable for painting safety lines around machinery. WALTER S. NISSLY, York, Penn.

Hoists, Shovels and Cranes. A strikingly illustrated booklet, entitled "Quality Engineering," describing the hoists, shovels, cranes and other equipment of the AMERICAN HOIST AND DERRICK CO., St. Paul, Minn.

Sand and Gravel Washers. Booklet describing the principles of operation of Eagle gravel washers and sand washers. Completely illustrated with full details and specifications. EAGLE IRON WORKS, Des Moines, Iowa.

Concrete Products Machinery. No. 5 of "Besser Tampings" contains an interesting article on important things that are happening in the concrete products industry. BESSER MANUFACTURING CO., Alpena, Mich.

Transmission Units. Folder covering transmission units, built in 16 sizes, giving from fractional to 150 hp., and in ranges of speed adjustability from 2:1 up to 16:1 ratios. REEVES PULLEY CO., Columbus, Ind.

Explosives. Explosives Service Bulletin for December contains a very enlightening article on "Lighting Fuse" by F. P. Griswold. E. I. DU PONT DE NEMOURS AND CO., INC., Wilmington, Del.

Manganese Steel. The Amsco Bulletin for February (Vol. II, No. 2) contains interesting facts on products made of Amsco manganese steel and "Fahralloy." AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill.

Vibrating Screens. No. 171 of "The Labor Saver" for January features an interesting article on "The Inside Story of the Vibrator Screen." STEPHENS-ADAMSON MANUFACTURING CO., Aurora, Ill.

Vibrating Screens. No. 1, Vol. 3 of "Good Roads," the interesting house-organ of the Good Roads Machinery Co., contains an interesting article on vibrating screens. GOOD ROADS MACHINERY CO., Kennett Square, Penn.

Stokers. A very attractive catalog, splendidly illustrated, giving the structural features, operating data and other details on the C-E Multiple Retort Stoker. COMBUSTION ENGINEERING CORP., New York City.

Vibrating Screens. Bulletin **No. 1470** covering centrifugal vibrating screen with positive mechanically produced motion, driven through a Texrope drive by dustproof motor mounted on screen frame. ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.

Pulverizing Mills. Bulletin **No. 902,** describing pulverizing mills for rock products in the air-separation and screen-separation types, in a variety of sizes with capacities ranging from 1000 lb. per hour to 30,000 lb. per hour. FULLER LEHIGH CO., Fullerton, Penn.

Centrifugal Pumps. Bulletin **No. 214,** completely illustrating and describing single stage, double suction centrifugal pumps, ball bearing type, suitable for capacities up to 1800 g.p.m. against heads up to 300 feet. PENNSYLVANIA PUMP AND COMPRESSOR CO., Easton, Penn.

Water Turbines. Publication **No. E-1132** describes small water turbines of the reaction, inward flow or vortex type, equipped with either fixed or movable guide vanes, and with suitable governors, according to the service required. DE LAVAL STEAM TURBINE CO., Trenton, N. J.

Cones and Tanks for Sand and Gravel Plants. Bulletin **No. 35,** completely describing cones and tanks for sand and gravel plants and giving practical information on the classification of sands, treatment of silica sands, settling and dewatering by using automatic settling cones and tanks. THE ALLEN CONE AND MACHINERY CORP., New York City.

"Economy of Soft Water." Bulletin **No. 120,** a new 16-page bulletin on the Elgin Zeolite system, discussing the advantages of soft water in various industries, the problems of scale, rust, corrosion, and influence of hard water upon fuel bills, etc. Exceptionally well illustrated with diagrammatic sketches and photographs. ELGIN SOFTENER CORP., Elgin, Ill.

Gyratory Crushers. Bulletin **No. 3100,** superseding **No. 2100** and describing the Traylor Bulldog gyratory crusher, Type T, with such notable features as an extremely long eccentric which reduces the bearing pressure to the lowest point, automatic force-feed lubrication system which supplies the eccentric bearing, gears and countershaft bearing with oil at all times, etc. TRAYLOR ENGINEERING AND MANUFACTURING CO., Allentown, Penn.

Rock Drilling. Booklet **No. 72-K,** entitled "Handbook of Rock Drill Steel," a 48-page book, fully illustrated, giving practical working hints as to the proper handling of the drill steel problem. The book contains instructions for the operation of the different types of drill steel sharpeners and drill steel furnaces. There is a separate chapter on pyrometers and pyrometer control, and one on heat treatment of drill steel, as well as other valuable information. SULLIVAN MACHINERY CO., Chicago, Ill.

G-E Bulletins. GEA-1009B on Type WD-300A arc welder Buda gas-engine-driven welding current independent of local power limitations. **GEA-714B** covering the MD-400 line of direct-current mill motors especially suitable for shovels, dredges, cranes and hoists. **GEA-881C** on Type WD200A portable arc welder, Continental gas-engine driven. **GEA-1191,** an 85-page book, comprehensively describing and illustrating synchronous motors for three-phase units and for two-phase units, built in various forms and in ratings that cover the entire field of synchronous-motor applications. GENERAL ELECTRIC CO., Schenectady, N. Y.